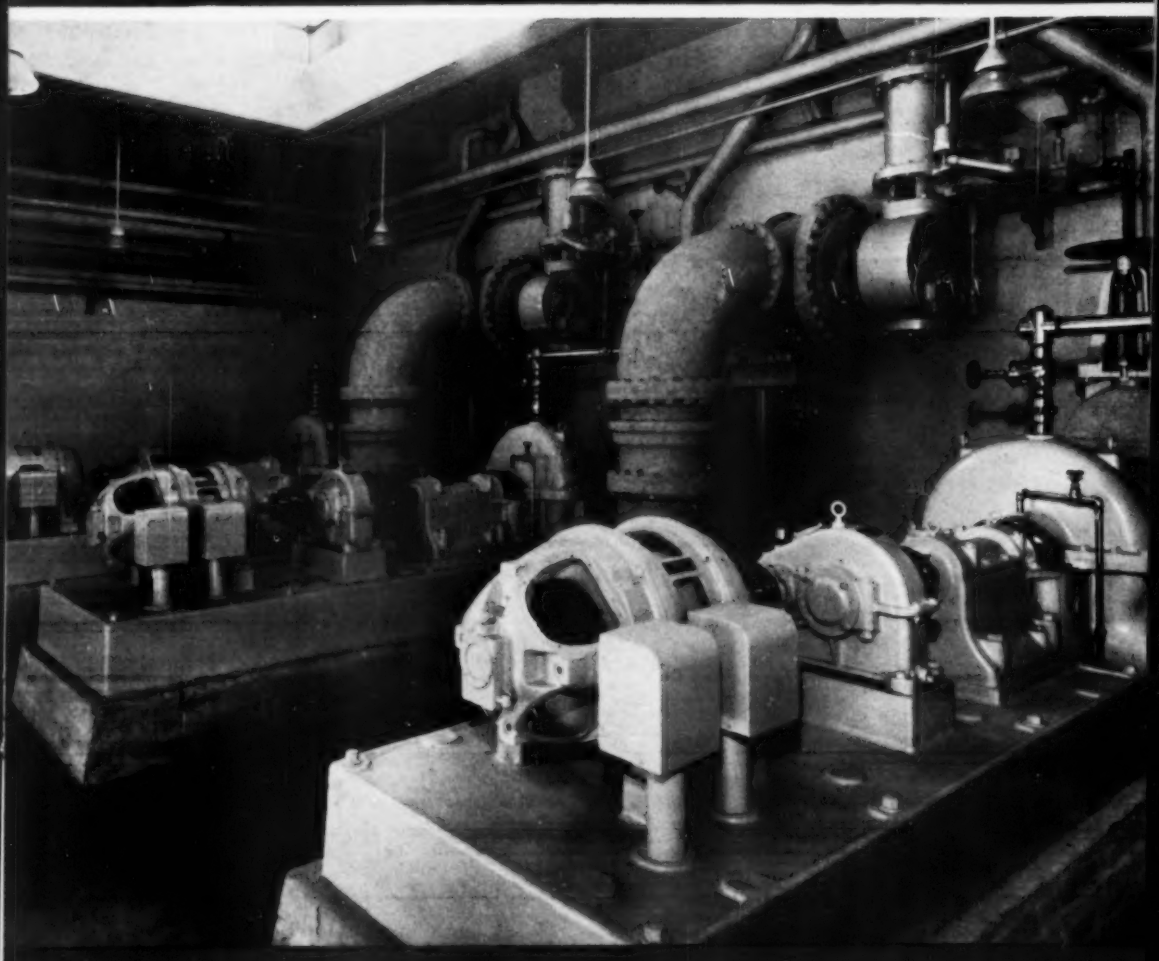
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



MARCH, 1952

Baltimore's Newest . . .
Sewage Pumping Station

SERVICE CONNECTIONS are no problem in LOCK JOINT Reinforced Concrete CYLINDER PIPE

★ FITTINGS AND EQUIPMENT NECESSARY FOR MAKING SERVICE CONNECTIONS

HOW TO TAP

1. Remove concrete down to cylinder in area to be tapped.
2. Assemble fittings around bars of reinforcing cage, drawing gland down firmly so that gasket fits tightly against cylinder.
3. Mount tapping drill on corporation stop and tap.
4. When tap is completed, protect steel fittings with a cement mortar encasement.

Making a service connection under pressure in a Lock Joint Reinforced Concrete Cylinder Pipe is that simple.

Yet with these few steps a foolproof tap is always achieved. There can be no cross-threading, no loss of alignment and no damaging of the pipe with attendant costly shut-downs and repairs.

Lock Joint Pipe Company will be glad to furnish, at nominal cost, the few fittings necessary to make service connections from ¾" to 2" in diameter in any pressure pipe of Lock Joint design. Fittings are also available for making large diameter flanged connections—with ease under pressure. For illustrated instructions on tapping any type of Lock Joint Pressure Pipe, write for booklet, "Tapping Lock Joint Pressure Pipe Under Pressure."

LOCK JOINT PIPE COMPANY

Est. 1905

P. O. Box 269, East Orange, N. J.

Pressure Pipe Plants: Wharton, N. J. Turner, Kan., Detroit, Mich., Columbia, S. C.

BRANCH OFFICES:

Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Valley Park, Mo. Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. Tucumcari, N. Mex. • Oklahoma City, Okla. Tulsa, Okla. • Beloit, Wis. • Rato Rey, P. R.

SCOPE OF SERVICES

Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

New York's City Hall, completed in 1811, as it looked 100 years ago

The City of New York has several cast iron water mains in service that were laid more than a century ago. They are part of approximately 5,000 miles of cast iron mains representing about 98% of all the pipe in New York's distribution system. The contrast in traffic and construction, above and underground, today and 100 years ago, is fantastic. Yet the shock-strength, crushing-strength and beam-strength of cast iron mains have enabled them to withstand the unforeseen stresses imposed by vast changes. Because of these strength factors and effective resistance to corrosion, cast iron water and gas mains laid over 100 years ago, are still serving in the streets of 38 cities in the United States and Canada.

United States Pipe and Foundry Company, General Offices, Burlington, N. J. Plants and Sales Offices Throughout the U. S. A.

U.S.
cast iron
PIPE
FOR WATER, GAS, SEWERAGE AND INDUSTRIAL SERVICE

NUMBER TEN OF A SERIES

Making Sewer Lines "Leakproof for Life" is as simple as

ABC

with

TYLOX

flexible-rubber

JOINTS

There's nothing simpler, nothing surer, than coupling concrete pipe with TYLOX — the flexible, rubber gaskets.

Here's all you do:

A. Brush TYLOX Cement on the pipe tongue and snap on the gasket.
B. Lubricate the sliding surfaces of both the pipe and gasket with TYLOX Cement.
C. Shove the pipe home to a full seat.

And, here's what you get:

A. TYLOX JOINTS are fully flexible joints — automatically compensate for angularity, soil stresses, pipe expansion or contraction — permanently eliminate infiltration or leakage.

B. TYLOX JOINTS are age resistant and chemically resistant joints—withstand the attack of virtually any sewage or industrial wastes, for the life of the line.

C. TYLOX JOINTS are fast coupling joints — require no "curing" or "setting" time — can be installed in the wettest ditch — permit immediate "back-filling" — make for lower "per laid foot cost."

It's just that simple! TYLOX JOINTS do the job and do it well! So try them on your next pipeline!

Write, wire or phone for specification data and literature on TYLOX Gaskets.

HAMILTON KENT MANUFACTURING CO.

KENT, OHIO

225 Gougler Ave. **Tel. 3449**

1707

"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. Published monthly by Gillette Publishing Co. at 404 North Wesley Ave., Mount Morris, Ill. Entered as second class matter Mar. 4, 1948, at the post office at Mount Morris, Ill., under Act of Mar. 3, 1879. For subscription rates, see Contents Page.

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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Improved Clarification at West Penn . . . . . J. W. Lawrence & T. Douglas
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Why they

call this pipe

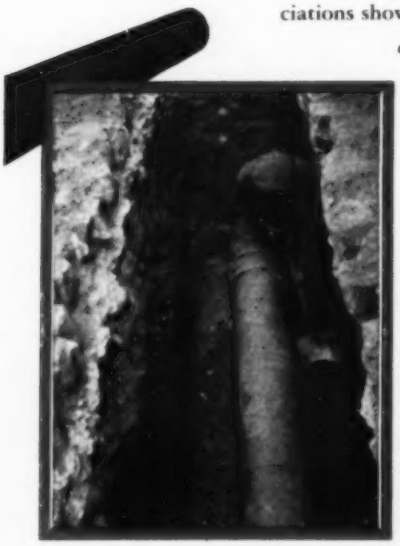
*America's No.1 Tax Saver

Top Tax Saver is the cast iron pipe in the water distribution systems of cities and towns throughout America. Beyond question, long-lived cast iron pipe has saved, and today is saving taxpayers millions of dollars. Why?

An estimated 60% of the $6-billion cumulative investment in America's water supply systems is represented by pipe and labor for the construction of supply and distribution mains, paid for usually by the issuance of bonds.

Leading waterworks engineers estimate the useful life of cast iron pipe at *4 to 5 times* the average term of a water revenue bond issue. They base their estimates on the fact that over 35 American cities have cast iron mains in service that were installed more than 100 years ago. Moreover, a survey sponsored by three waterworks associations shows that 96% of all six-inch and larger cast iron pipe *ever laid* in 25 typical cities, are still in service. Thus, the *strength factors* of long life, native to cast iron pipe, are self-evident.

When you consider that over 95% of America's water distribution systems are constructed with long-lived cast iron pipe, can you doubt that it is *America's No. 1 Tax Saver?*



America's oldest functioning water main is in its 135th year of service in Philadelphia's distribution system. Cast iron, of course. Over 30 other cities have century-old cast iron mains in service.

CAST IRON ®

CAST IRON PIPE

America's No.1 Tax Saver

*©1952, Cast Iron Pipe Research Association

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

PROGRESS REPORT

Philadelphia's Campaign for CLEAN WATERS

New 125,000,000 gallon-per-day Northeast Sewage Treatment Works, built to free Delaware River of pollution, utilizes over 100 G-E equipments

Over the years, almost 85 per cent of Philadelphia's sewage, currently estimated at 350 million gallons per day, has been poured untreated into the nearby Delaware and Schuylkill Rivers. Public and official displeasure with the resulting stream pollution led in 1945 to the adoption of a program for the completion of the sewage treatment system to serve the entire city area.

The first of three plants in the $60 million system, which is scheduled for completion in 1953, was placed in operation in April of this year. Designed for the future to serve the area's estimated 1970 population, the Northeast Sewage Treatment Works will abate pollution of the upper Delaware River.

G-E equipment in the new plant includes unit substations, switchgear and control, and over 75 drive motors. A less obvious but most important contribution to the effectiveness of the works has been G-E Application Engineering: fitting power-distribution and drive equipment to the job requirements.

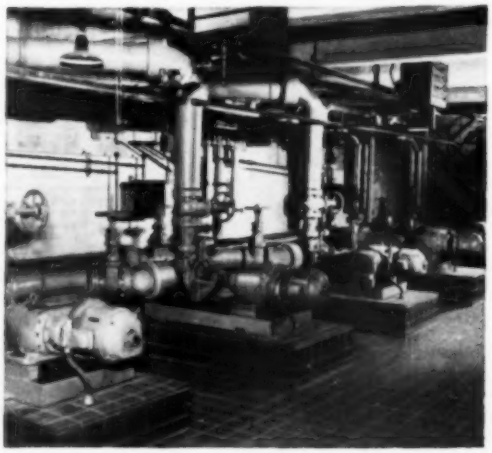
General Electric helps make your pollution-control program a success in two ways:

1. Aids in winning public support through the G-E packaged program "Modern Sewage Treatment" including the full-color sound movie *Clean Waters*.
2. Assists your engineers or consultants in the formation of electrical plans.

To take full advantage of these services, be sure to contact your G-E representative early in the planning stage. ***General Electric Company, Schenectady 5, N. Y.***

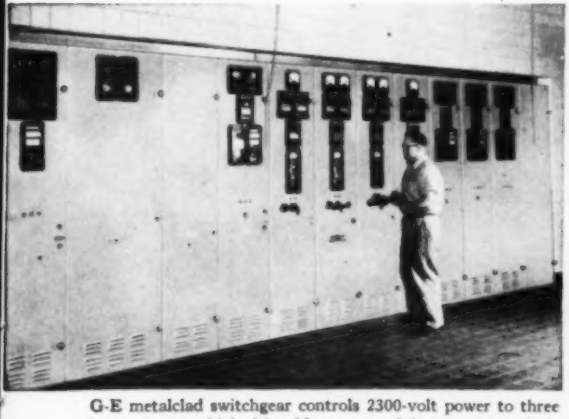
Forty-eight G-E ½-hp induction motors power the sludge collector mechanisms in these final settling tanks. G-E 1-hp motors perform a similar function in the primary tanks.

*Reg. Trade-mark of General Electric Company

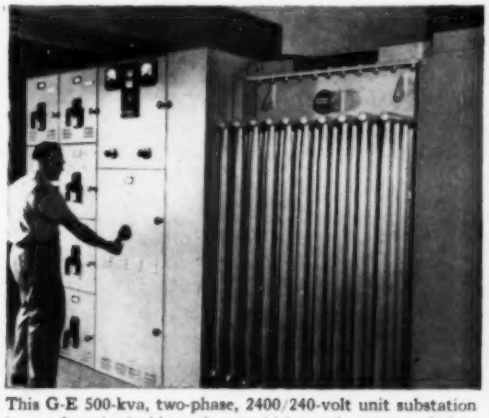


Three G-E Tri-Clad* 5-hp motors in foreground drive pumps which transfer sludge from primary tanks to heaters. In background, two G-E 7½-hp motors drive pumps which move warm sludge to digestor tanks after heating.

Northeast Sewage Treatment Works operates on the modified-activated-sludge process. Completion of Southeast and Southwest plants, will bring under treatment all sewage and industrial waste entering sewers in the Philadelphia area.



G-E metalclad switchgear controls 2300-volt power to three large motors which drive blowers supplying compressed air for the aeration tanks.

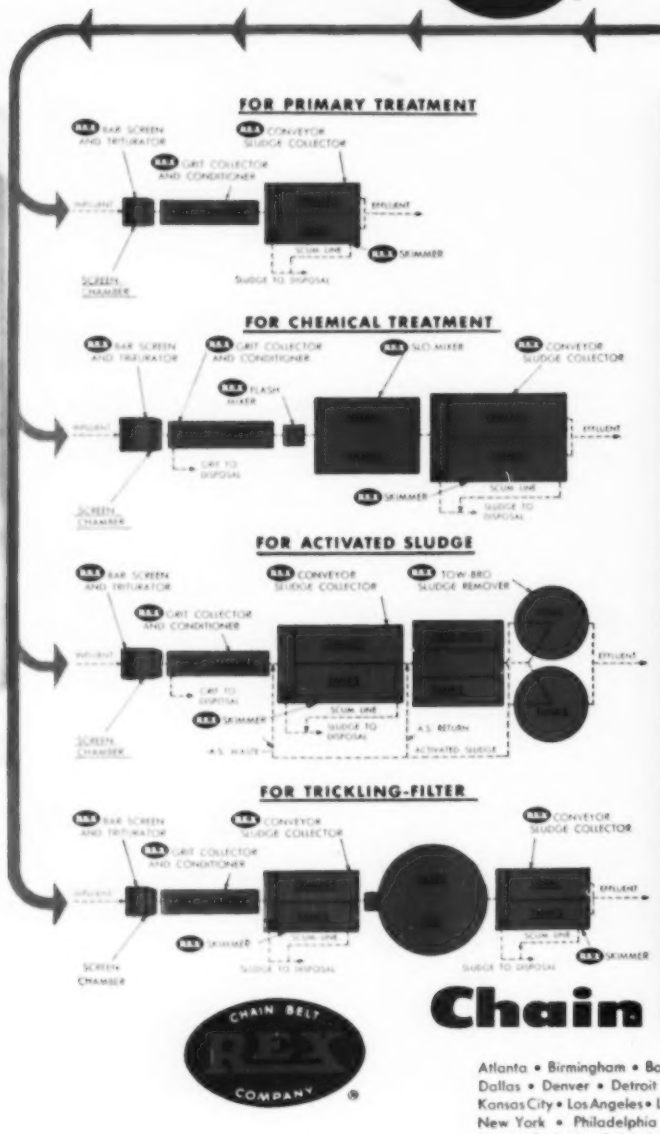


This G-E 500-kva, two-phase, 2400/240-volt unit substation is one of two in the blower house which supply power to sludge-pump and collector-mechanism drives.

GENERAL ELECTRIC

for best results...

PLAN YOUR PLANT ALONG THE REX® LINE



1. Modern treatment plants, regardless of size or type of process, require a multiplicity of arrangements and units.

2. The complete Rex line provides a broad selection of equipment that will best fit your requirements.

3. Selection of the right equipment is extremely important. The finest equipment in the world will not perform efficiently and economically if it is improperly applied.

4. Rex Sanitation Engineers are well qualified by years of training and experience to help you select the equipment which will best fit into your plans. Call them in when your job is still in the planning stage. You'll find it pays off in greater plant efficiency, improved performance, lower operation and maintenance costs. Chain Belt Company, 4610 W. Greenfield Ave., Milwaukee 1, Wis.

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Chain Belt COMPANY OF MILWAUKEE

Atlanta • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland
Dallas • Denver • Detroit • El Paso • Houston • Indianapolis • Jacksonville
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Mass. • St. Louis • Salt Lake City • San Francisco • Seattle • Tulsa • Worcester

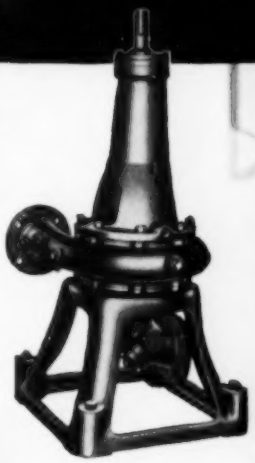
Export Offices: Milwaukee and 19 Rector St., New York City

There's No Catch in It!

What is it? It's a plastic model of the amazing new "Bladeless" impeller developed by Fairbanks-Morse pump engineers for Figure 5400 solids-handling pumps.

Why no catch in it? Because, unlike conventional impellers, there are no blades to catch and hold fibrous trash. It makes possible a truly "non-clog" pump. The chain in the illustration follows the water path through the single channel impeller and shows clearly that there's no "catch" possible. And that's important from a maintenance and operating cost angle because the ordinary solids-handling pump often must be dismantled as much as twice daily to clear clogged impellers.

This new advance in pump design is typical of the constant research and product improvement that make possible the high quality and efficient performance of all Fairbanks-Morse products. Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Illinois.



Fairbanks-Morse Figure 5400 solids-handling pump, featuring the "single channel" impeller. Phantom view of impeller clearly shows that there are no "blades" to catch or damage pumped material.

FAIRBANKS-MORSE,

a name worth remembering

PUMPS • SCALES • ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES • DIESEL, DUAL FUEL AND GASOLINE ENGINES • HOME WATER SERVICE EQUIPMENT FARM MACHINERY

. . . it's the new RING-TITE JOINT used with Transite Sewer Pipe

NO NEED TO LET ordinary time-consuming methods of making joints slow down your sewer line jobs—not when you install Transite* Sewer Pipe with its new Ring-Tite Coupling.

Just a simple assembly operation with a mechanical coupling puller and this new "packaged" joint is ready for business! No jointing compounds to bother with . . . no heating equipment . . . no special skill is required. And you can check each joint for proper assembly as soon as it is made—*before backfilling.*

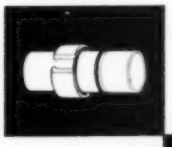
Moreover, this easily assembled Ring-Tite Coupling makes a tight joint that *stays* tight in service. This, plus the fact that Transite's long 13-foot lengths mean *fewer* joints in the line, cuts infiltration to a minimum. As a result, treatment costs are reduced, plant capacity conserved for future needs.

Another money-saving advantage of this asbestos-cement pipe is its high flow capacity (Manning's n=.010). This often permits flatter grades and shallower trenches—a particularly important economy where pipe is laid at or below the ground water line or where rock excavation is required.

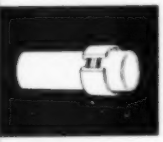
May we send you more complete data? Address Johns-Manville, Box 290, New York 16, N. Y. Ask for folder TR-103A.

*Transite is a registered Johns-Manville trade mark

HERE'S HOW THE RING-TITE JOINT WORKS:



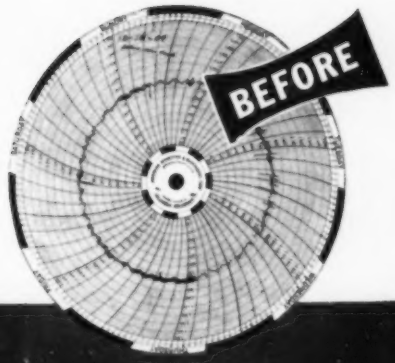
Start of assembly. Two rubber rings and a Transite sleeve (cut away to show position of the rings) are placed on one of the two pipe ends to be joined.



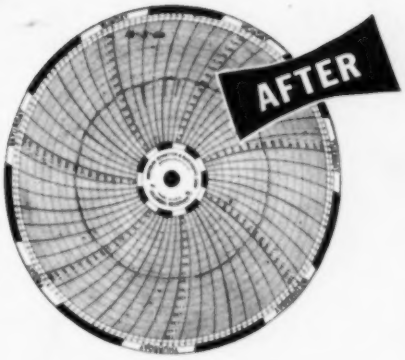
Final position. Sleeve centered over both pipe ends, with the rubber rings tightly compressed between sleeve and pipe.

Checking joint for proper assembly. This is done with a simple gauge immediately after the joint is made . . . *before backfilling.*

Johns-Manville TRANSITE SEWER PIPE



HERE'S THE STORY



THIS HORTON TANK reduced water pressure variations in Mooresville

Once again, a Horton elevated water tank is directly responsible for giving a growing city better water service.

Until recently, Mooresville, N.C., relied on 100,000 gallons of elevated storage in its municipal water system. Although this had proved adequate at one time, recent growth necessitated additional storage capacity. So, last year, a new 500,000-gallon Horton tank was installed. As a result, water pressure variations have been reduced an average of 50 per cent—even during peak load periods.

Like many cities, Mooresville has long realized the advantages of elevated water storage. Such qualities as proven dependability—higher pressures—and lower pumping costs can't be ignored!

Horton elevated water tanks with ellipsoidal-bottoms are built in standard capacities from 15,000 to 500,000 gallons. Larger tanks with radial-cone bottoms are built from 500,000 to 3,000,000 gallons.

Write our nearest office for details.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

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Detroit 26	1551 Lafayette Building	Tulsa 3	1646 Hunt Building
Houston 2	2115 C & I Life Building	Washington 6, D.C.	1109 Cafritz Building

CONCRETE PIPE

Gives You Strong, Durable, Economical Sewers

Leading sanitary engineers specify concrete pipe for sewers because it offers:

1. **GREAT STRENGTH** to sustain heavy overburdens, to resist severe impact and to withstand the wearing action of tough climatic or soil conditions.
2. **MAXIMUM CAPACITY** due to its smooth interior finish and clean, even joints.
3. **MINIMUM INFILTRATION AND LEAKAGE** resulting from its uniformly dense structure and tight joints.
4. **UNUSUAL DURABILITY** that enables it to give long years of heavy-duty service.
5. **ECONOMY.** Moderate first cost plus little or no maintenance expense divided by long years of service equal ***low annual cost,*** the real measure of pipe line economy.

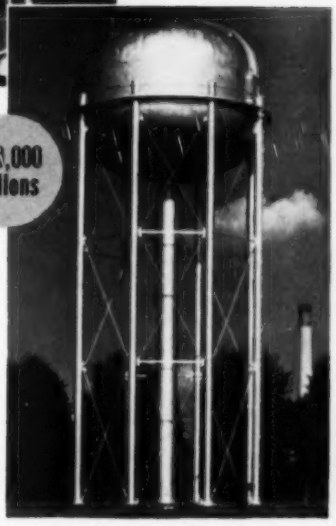
AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

1,000,000 Gallons

ECONOMY and APPEARANCE

***DESIGN ADVANTAGES** that benefit every PDM double ellipsoidal tank installation in a wide range of capacities.*



500,000 Gallons

100,000 Gallons

PITTSBURGH •DES MOINES *Elevated Steel Tanks*

In capacities up to a million gallons, the Pittsburgh-Des Moines *Double-Ellipsoidal* Elevated Steel Tank design represents excellent values in comparative cost and good appearance. Available with structural or tubular column towers, this PDM tank type is widely favored for municipal water storage.

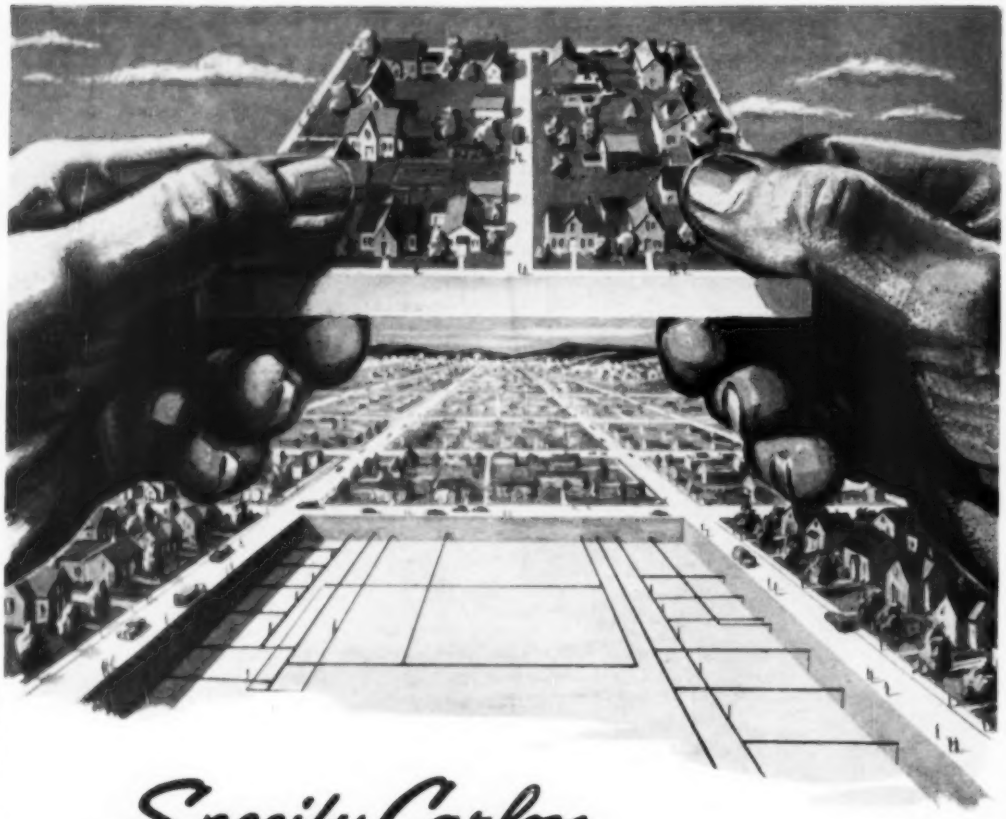
● Let us discuss the details with you.

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle Street
NEWARK (2)	218 Industrial Office Bldg	DALLAS (1)	1223 Praetorian Building
CHICAGO (3)	1222 First National Bank Bldg	SEATTLE	526 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd	SANTA CLARA, CAL	625 Alviso Road



Specify Carlon...

FOR LONGER PIPE LIFE

Combining the inherent advantages of plastic with the desirable characteristics of metal, CARLON plastic pipe is the superior new medium for fluid and gas transmission. Whether used for municipal water systems, sewage disposal, land drainage or other medium-pressure low-temperature applications, it assures more years of dependable, trouble-free service than ordinary pipe.

CARLON is absolutely guaranteed against rot, rust and electrolytic corrosion . . . is inert to the chemical action of corrosive waters and soils . . . and will not accumulate scale or sediment. It features light weight (only ⅛ as much as steel), flexibility, and ease of installation.

CARLON plastic pipe can be installed quickly without special tools or materials handling equipment. It is furnished in long lengths which require a minimum number of fittings. A complete line of molded plastic fittings is available for joining lengths of CARLON or for connecting this new pipe with previously installed metallic systems.

Specify the Pipe with the Stripe!

CARLON CP

CARLON PRODUCTS CORPORATION

IN CANADA: MICRO PLASTICS, LTD., ACTON, ONTARIO

10300 MEECH AVENUE • CLEVELAND 5, OHIO

For low flow . . . for storm conditions
TRITOR SCREEN
efficiently removes screenings and grit

City of Kirksville, Mo., employs a Link-Belt Tritor Screen at each of two sewage treatment plants. J. W. Shikles & Co., Kansas City, Mo., Consulting Engineers.

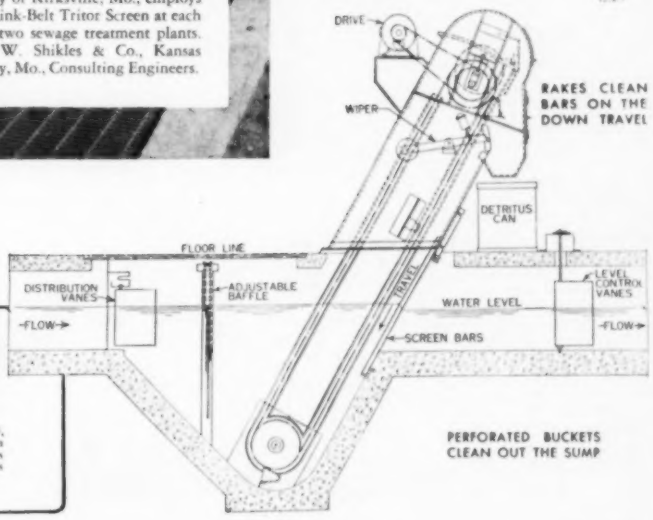
LINK-BELT combines bar screen and grit chamber in one economical unit

OVER 70 small and medium size treatment plants enjoy the savings provided by the Link-Belt Tritor Screen.

It combines the functions of a mechanically cleaned bar screen and grit chamber in a machine that is economical and easy to install. Used ahead of comminutors or screenings shredders, the Tritor removes large solids to reduce wear on cutting parts. Two adjustable baffles provide velocity control for minimum flows.

When Tritor Screens are installed in conjunction with screenings shredders, screenings may be shredded and returned to the sewage flow during periods of low flows when no grit is coming to the screens.

For details on Tritor Screens and other equipment in the broad Link-Belt line, call the office near you. A Link-Belt sanitary engineer will be glad to give you complete information.



LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Philadelphia 40, Chicago 9, Indianapolis 6, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities.

Transite Pipe is a product of modern engineering and research. Shown above is one of the buildings at the Johns-Manville Research Center at Manville, New Jersey.

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE

TRANSITE PIPE last longer
California city streets?

Transite Pipe was first installed by this California city nearly 20 years ago. Its lasting strength and high corrosion resistance have enabled it to outlast pipe previously used several times over.

Research designed it for lasting strength

TODAY, ACROSS THE COUNTRY—under countless city streets like the one shown above—Transite® Pressure Pipe is doing a highly efficient job of transporting water . . . often under conditions so adverse to ordinary pipe that engineers marvel at Transite's ability to stand up through the years!

The reason? *Lasting strength!*

Not only does Transite Pipe have the *initial* strength that's needed in a pipe intended for use under busy city streets. Equally important, it has the *lasting* strength that enables it to survive continued corrosive attack, year after year . . . to keep on giving the same dependable, economical service to the community as the day it was installed.

This highly important quality of lasting strength is one of many notable inherent advantages of a pipe engineered with modern water transportation requirements in mind. Transite's Simplex Couplings reduce leakage losses to a minimum, provide flexibility to help relieve the line of soil stresses and traffic loads. Its light weight makes for easier handling and effects substantial savings during installation. Its smooth interior assures a high coefficient of flow (C=140) and, because Transite can never tuberculate, helps keep pumping costs low through the years.

Why not get all the details . . . find out how this modern-engineered-for-the-job asbestos-cement pipe can help solve your water-line problems and *save you money?* For full information, write Johns-Manville, Box 290, New York 16, N. Y.

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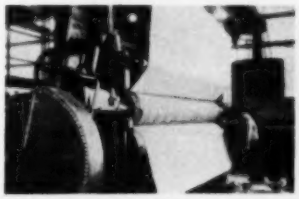
Tough, strong asbestos fibers reinforce Transite Pipe—contribute to its high corrosion resistance and lasting strength.



On machines like this, the asbestos-cement-silica mixture is "built up" under heavy pressure into a dense, homogeneous pipe structure.

Transite's flexible Simplex Couplings help relieve the line of excessive flexural stresses—an added safeguard against pipe failures.

asbestos-cement PRESSURE PIPE

Run of "Century" Asbestos-Cement Pressure Pipe supported on bridge. Note that "Century" Pipe needs no protective painting; external corrosion factors can't affect it.

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"Century"®

asbestos-cement pressure pipe!

Strong . . . durable . . . a water main that will successfully resist exposure to the elements without need of protective treatment—that's "Century" Pipe!

Consider the strength factors that this run of "Century" Pipe has in common with the supporting bridge:

"Century" Pipe is made of practically indestructible materials—Portland cement, reinforced with strong, tough asbestos fibers.

Like the bridge, "Century" Pipe has been built with an extra margin of safety to make certain it is *stronger than it will ever need to be.*

And, like the bridge, "Century" Pipe can "take" traffic vibration. The "Century" Simplex Couplings actually cushion both ends of each pipe section in rubber—which helps to absorb the shocks and vibrations of passing traffic.

When, in addition to the strength of "Century" Pipe, you consider the other long life factors—resistance to corrosion, tuberculation, and electrolysis; and the economy—the fact that it can be laid quickly with a minimum of special skills; you'll quickly see why *before you buy or specify any pipe for water mains, it will pay you to investigate "Century" Asbestos-Cement Pressure Pipe.*

WRITE FOR FREE BOOKLET, "Mains Without Maintenance." Contains valuable reference material, specifications, and data for anyone interested in pipe for water mains. FREE—write for it.

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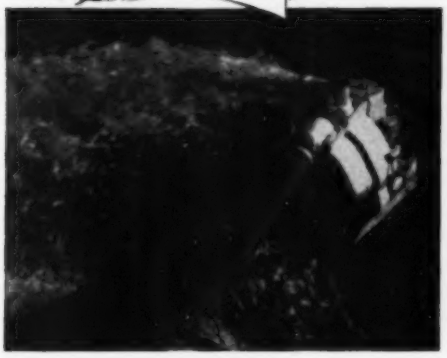

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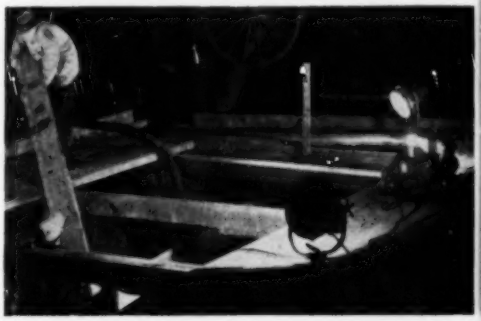

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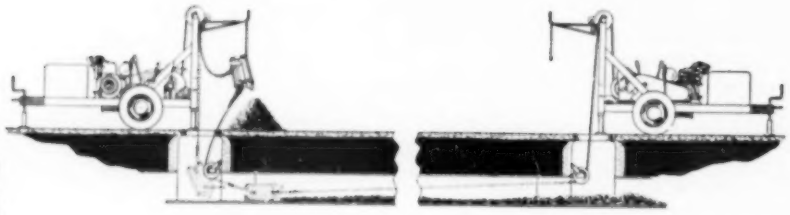

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Layne enjoys the distinction of being the world's most experienced well water developers. No other organization has so much to offer those who are in need of well water supply units. Whether the requirements are for thousands or millions of gallons of water daily, Layne is ready to serve you. For further information address

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Layne's newest water supply catalog is of utmost interest to all who are contemplating the installation of a water well and pump. It illustrates and describes the many fine features of Layne built wells and Layne Vertical Turbine Pumps. A copy will be sent on request.

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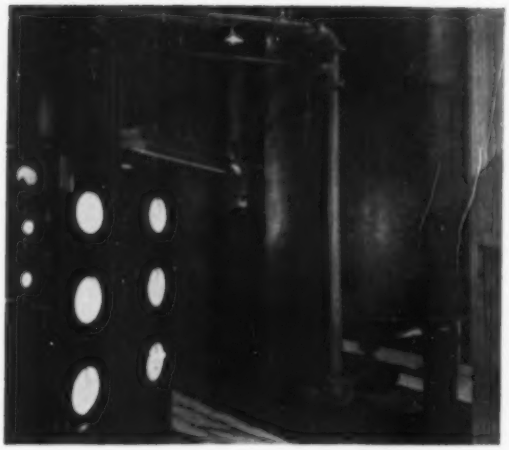
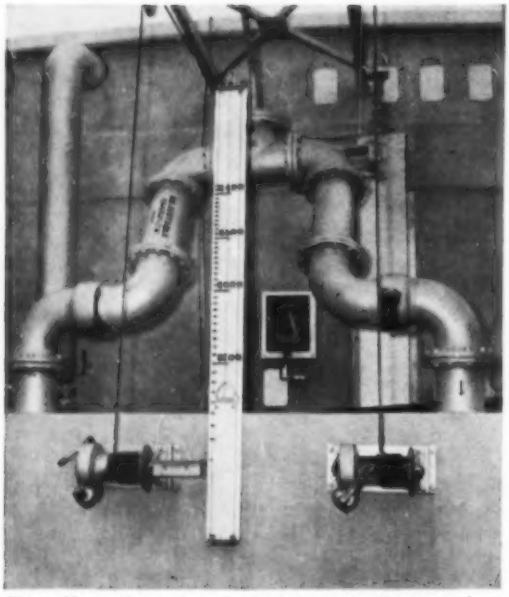


Brown instruments on this panelboard measure and control temperature and liquid level in decanters at Cooper-Bessemer Corp., Grove City, Pa.

Modern waste plants prefer

BROWN LIQUID LEVEL GAUGES



Electro-Vane Alarm shows level of sludge in digester tank at Hyperion Activated Sludge Plant, Los Angeles, California.

because . . .

. . . Accurate, sensitive level measurements make it possible to operate digesters, decanters and other equipment at top capacity.

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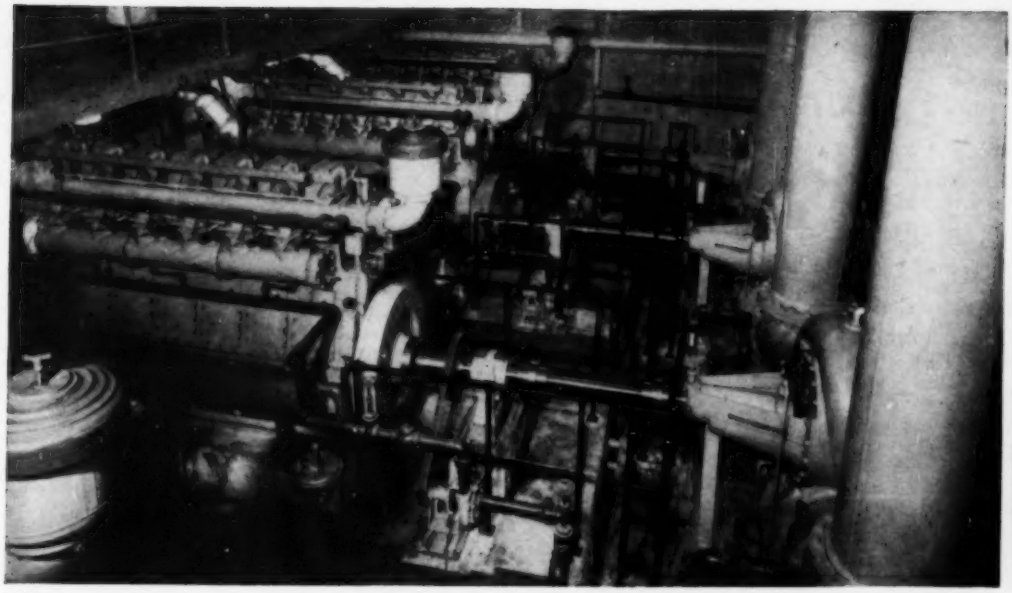


FOUR 20-MGD CENTRIFUGAL PUMPS (right) pump raw sewage into Oklahoma City's Southside Sewage Treatment Plant. Worthington Sewage Gas Engines (left) drive pumps. Installation uses three other such pumps for recirculation, also driven by Worthington engines.

An exact match for Oklahoma City's needs

The right *equipment for new sewage plant selected from Worthington's complete line*

An outstanding job in every way. That's what they're all saying about the new Southside Sewage Treatment Plant at Oklahoma City.

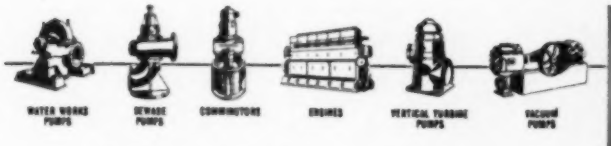
Seven giant Worthington 20-mgd centrifugal pumps used for pumping raw sewage and recirculation are driven by Worthington gas-engines that are fueled by methane gas from raw sewage.

Oklahoma City's modern plant—like virtually every municipal installation—had *special* requirements. They met these requirements with Worthington equipment—engines, pumps, and other apparatus such as air compressors.

To municipalities like Oklahoma City, Worthington means getting *all* major public works equipment under *one* responsibility. Engines for any available fuel, the world's most complete line of pumps, comminutors, air compressors, water treating equipment, motors, and power-transmission equipment.

Write us—learn all the reasons why *there's more worth in Worthington*. Worthington Pump and Machinery Corporation, Public Works Division, Harrison, N. J.

W.3.2



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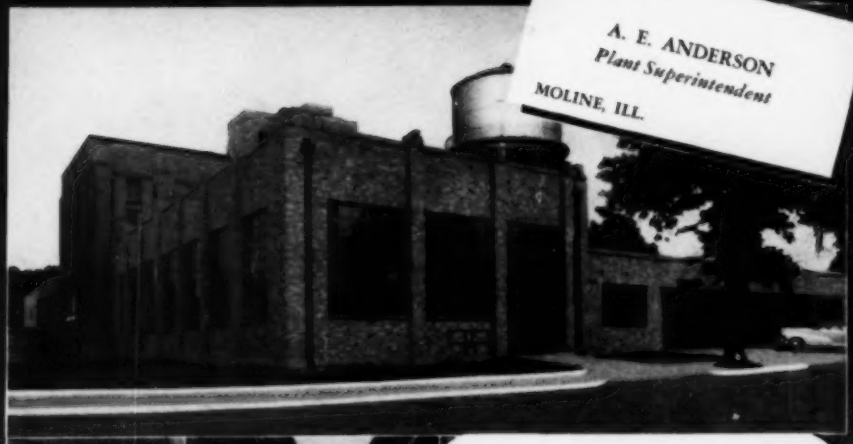

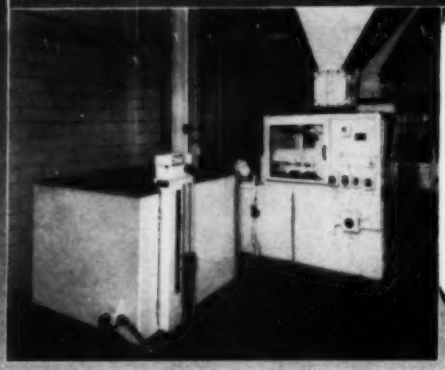

B-I-F Industries Equipment furnished for the Moline Water Works:

1 — Omega Precision Solution Feeder with make-up tank for Calgon

2 — Omega 500# Lime Slakers

4 — Omega Explosion-Proof Belt Gravimetric Feeders for alum, quicklime and carbon — arranged for proportional control

Builders Raw Water and High Service Venturi Meters

Builders Filter Controllers and Gauges

Builders Filter Operating Tables

Since 1883, the Moline Water Works has undergone several major improvement programs, one of which is currently being brought to completion. This present project affects every phase of the Water Works from the intake in the Mississippi River to the pumping station and feeder mains. It also represents a big advancement for the city. The new work will bring plant capacity up to the proper level to satisfy both municipal requirements and National Board of Fire Underwriters' codes. It will also provide for water softening, which will effect an estimated annual saving in soap and softening compounds of $70,000 for the consumers.

Omega Chemical Feeders have been installed for feeding dry chemicals for coagulation and flocculation, and for control of pH, taste and odor, and scale forming compounds. The majority of these feeders, installed by Johnson Bros. Heating Co., Chicago, Ill., are arranged for proportional control, paced by the flow rates through the plant. For Bulletins describing Omega Water Works Equipment, address Omega Machine Company, (Division of Builders Iron Foundry), Providence 1, R. I.

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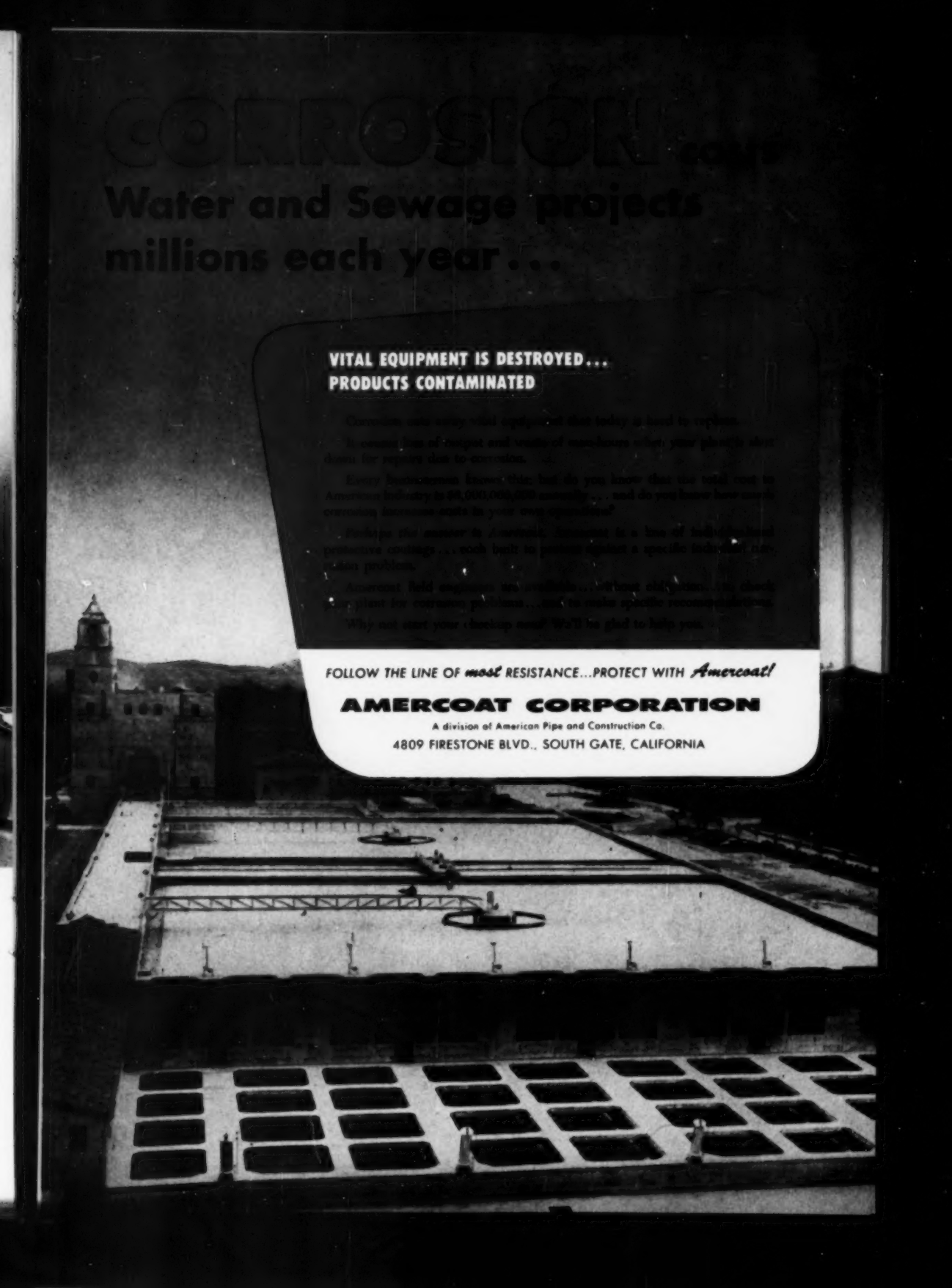
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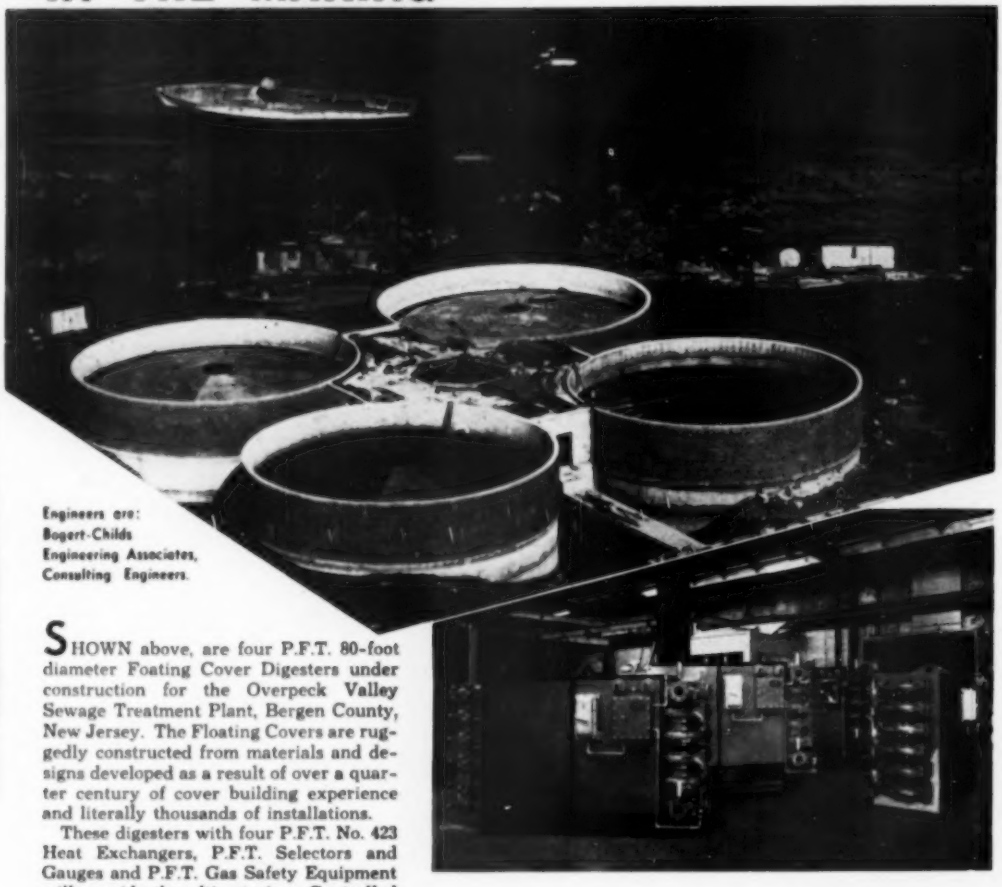

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SHOWN above, are four P.F.T. 80-foot diameter Foating Cover Digesters under construction for the Overpeck Valley Sewage Treatment Plant, Bergen County, New Jersey. The Floating Covers are ruggedly constructed from materials and designs developed as a result of over a quarter century of cover building experience and literally thousands of installations.

These digesters with four P.F.T. No. 423 Heat Exchangers, P.F.T. Selectors and Gauges and P.F.T. Gas Safety Equipment will provide the ultimate in a Controlled Digestion System with built-in flexibility for present and future needs.

Each of the P.F.T. No. 423 Heat Exchangers, shown at right, has a rated sludge heating output of 873,000 B.t.u. per hour and is provided with automatic controls to maintain within 1 degree the temperature of one of the digesters by circulating the digester contents through the Heat Exchanger. Waste heat from the sludge gas engines is utilized by circulating the engine jacket cooling water through the Heat Exchangers.

Here again P.F.T. equipment based upon P.F.T. experience gained in developing this modern method of external sludge heating and hundreds of successfully operating installations assures efficient and dependable operation.

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3. *High beam strength.* Price Prestressed Pipe makes your water line safe from external loads. It is shatterproof—and sudden and complete failure is all but impossible.

Don't overlook the other advantages of Price Pipe. *It's easy to lay*—can be installed quickly and easily because of its simple, self-centering joint. *It's easy to tap*—any service man does the job with regular equipment and a few accessories. *It's watertight*—the rubber and steel flexible joint adjusts to expansion, contraction, vibration and external loads without leaking. *It has great economy*—because of low original cost, low maintenance and extra-long, trouble-free life.

Are your present water lines as ageless as limestone? Do they carry as much water as the day they were installed? Are they free from sudden bursting and resulting floods? If not, learn all about Price Prestressed Pipe—with its steel cylinder plus an encasement of concrete inside and out. Our engineers know pipe line problems. Call them today.

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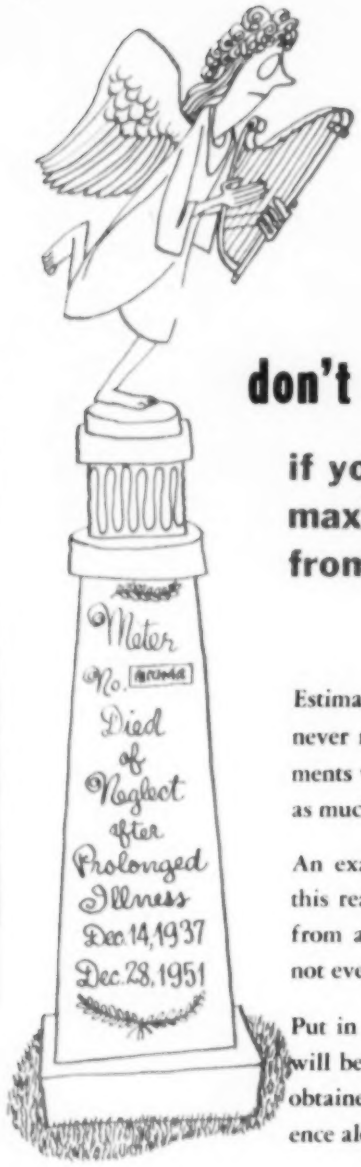

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WATER & SEWAGE WORKS

VOL. 99, NO. 3 • A GILLETTE PUBLICATION • MARCH 1952

NORWEGIAN HOMES as built by the Vikings and today—always the sod roofs.

Municipal Water Supply of Scandinavia

Part I—Norway

by A. L. KNOEDLER, *Senior Eng'r., Sheppard T. Powell, Eng'rs., Baltimore, Md.*

DURING the past summer the writer had the opportunity to visit the municipal water supply plants of the capitals of the four Scandinavian Countries. The peoples of these countries have been justly famous for years because of their progressiveness, their lack of slums and their cleanliness. The same qualities are apparent in the construction and operation of their water treatment plants and no tourist need fear the consequences from freely using water from the municipalities. Unlike some countries, these nations have the same high respect for the health of their citizens as we do in this country. The similarities between our peoples and those of the Scandinavian countries are very marked and differ only in their spoken language.

The Norwegians are a people who make full use of the roughness of their country to turn it to their advantage. They early learned the desirability of air-conditioning and proper insulation. One of the accompanying photographs shows the type of Norwegian houses which date back hundreds of years to the time of the Vikings. The roofs were constructed of layers of birchbark covered with several inches of sod. In winter the soil helps keep the heat in and in summer the grass remains moist and keeps the upper floor of the house cool. Such wood construction is possible because of the large forest areas —heavy timbers being used to support the heavy roof loading, especially after the great snows. Another photograph pictures a modern summer home in Denmark of the same general design with sod covered roof.

CHURCHES still show influence of the Pagan Gods

Another picture is that of the first Christian Church which still shows the influence of the Pagan Gods. Of especial interest is the tarry resin long, and generally, used as preservative to cover the wood. It is similar to the coatings and impregnations employed as wood preservatives in this country today.

Oslo's Water Supply

Water supply problems in Norway are not serious because the Norwegians have developed great series of natural lakes. The lakes adjacent to Oslo are located at a sufficiently high level to supply water to the city by gravity.

In recent years, the city has expanded outward and upward since the industrial area lies in a valley along a Fjord but the newer development has extended up into the surrounding hills. To supply the new areas with water, it has been necessary to install booster pumping stations to deliver water at an appropriate pressure. However, it is now planned to construct dams, forming new lakes at higher level to the left of the main runoff area, and thus deliver these supplies by gravity directly to the

INGENUITY in design and construction of Oslo's Langlia Dam

newer areas at a pressure of about 200 psi. Additional areas to the right, also, are being cross-connected either to the present reservoir system or directly through additional pipe lines to the newer sections of the city. This will provide a flexible system with standby equipment in the form of pump stations equivalent to our loop systems. The arterial mains carry various pressures from 150 to 250 meters (492 to 820 ft.), making it necessary to use pressure control stations.

Ingenious Dam Design

Numerous lakes extend north from the city which by means of pipe line and suitable dams have been tied into one system feeding the principal reservoir. The Langlia Dam in Nordmarko is shown in accompanying photographs. The design of this dam is ingenious. Since the dam was constructed for water supply only, not for power development, it was desired to use a minimum of concrete. What appears to be windows in the face of the structure are aperatures in a false front, which front serves to prevent the cold winter winds from contacting the main structure. This use of dead air space to insulate the concrete from air much colder than the water on the front side of the dam, together with the marked curvature of the walls saved more than one-half the concrete needed if other designs had been followed.

Although the reservoir behind the dam has a large storage capacity, not all of the water is available to the city. Part of the water supply for Oslo has been developed on lands owned by individuals. In one such case the owner had large timber reserves and the cut timber from these areas is floated downstream to mills for manufacturing paper. The city has provided suitable sluices at the side of the dam, as shown in one of the photographs, which release a certain minimum amount of water to carry the logs downstream to the mill.

Water Demands per Capita

With proper regulation the storage system can supply an average of 100,000,000 gallons of water per day throughout the year. This is more than adequate to meet the annual needs of the population of approximately 350,000 persons who use on the average of about 120 gallons per day per person. This is a high per capita consumption for a European city and Dr. Abel Wolman, an eminent authority in this field, has pointed out that the water consumed by the people is a fairly good index of the industrial progress of a nation. By such standards Norway, in general (Oslo, in particular), are leaders. The trend in per capita water consumption for three of the Scandinavian countries visited is revealed in the accompanying graph (Fig. 1). Data for Norway were available only for 1950, the figure being 120 gpd per capita, constituting considerably the highest per capita water demands of the Scandinavian countries.

All water sold to industries and other large users is metered. Domestic supplies are not metered but are charged on the basis of the *value of the home served*, since it has been found that water consumption is nearly proportional to the value and size of the house. This probably is due, in part, to the fact that it is the kitchen and bathroom facilities installed in homes, together with the number of servants employed, that results in high water consumption. The greater these facilities the higher the value of the property in general.

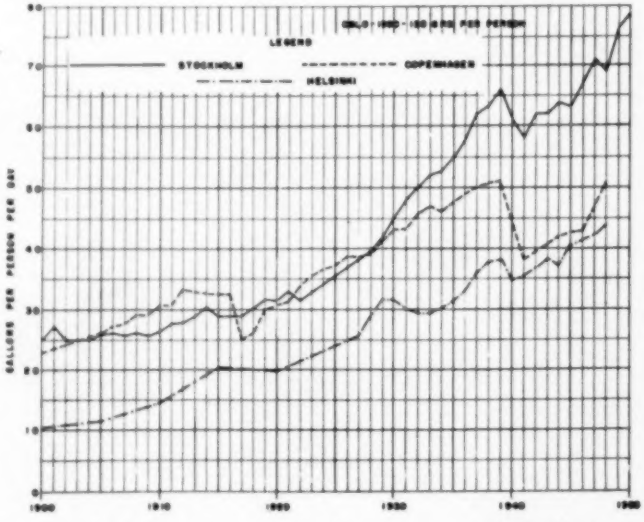


Fig. 1—Trends in water consumption in gals. per capita per day for Scandinavian cities

WATER in abundance—Langlia's spectacular spillways

Table 1

ANALYSES OF REPRESENTATIVE WATERS OF NORWAY
(Results Expressed in Parts per Million)

Constituents	As	Samples Typical	Samples Extreme
Chloride	Cl	6.90	15.00
Sulfate	SO_4	trace	trace
Nitrate	NO_3	1.00	0.00
Iron	Fe	0.25	0.16
Manganese	Mn	0.03	0.03
Ammonia	NH_4	0.07	0.05
Free Carbon Dioxide	CO_2	5.50	
P—Alkalinity	$CaCO_3$	0.00	0.00
M—Alkalinity	$CaCO_3$	0.03	0.00
Oxygen Consumed (Permanganate)		4.50	1.30
Evaporated Residue		28.00	37.00
Volatile Residue		6.80	6.00
Ignited Residue		21.20	31.00
Turbidity Pt.		1.2	1.2
Color Pt.		25.0	9.00
Taste		none	
Odor		none	
pH Value		5.20	4.30

Note:
% oxygen saturation nearly 100%
Temperatures 1°-20° C.
Residual color following 15 ppm alum treatment = 10 Pt.

Water Treatment

Generally, treatment of the raw water is not too difficult since the water originates from forest areas free from industrial and most domestic or farm wastes. The lakes are relatively deep and act as natural sedimentation and purification basins. What little sediment is present consists mainly of small particles of vegetation, too fine to settle out but easily removed by screening. In practice, fixed screens of very fine mesh wire are used to remove this material. They are effective in producing a clear water.

Moving screens would be preferable to stationary ones since it is necessary to clean the screens every three or four days. In summer, algae and other growths cause interference and make screen cleaning difficult. No other treatment is required except chlorination, which is practiced only as a precautionary measure.

In the past, chlorinating equipment from Germany has been used but expanded demands have made it necessary to add additional facilities which have been purchased in this country. A chlorine residual of 0.3 to 0.6 parts per million is maintained, depending on the time of the year.

The raw waters of Norway are of unusually good quality and are similar to some of our New England supplies. Since the water flows over rocky ground and through deep lakes, it has nearly the quality of rain or melted snow containing little in the way of dissolved material, but having a pH of about 6.2 and some color. A typical analysis of water from Southern Norway is shown on Table 1. Included, also, in the table is a water sample that is classified as extreme in Norway with respect to its total dissolved solid content.

It is apparent from the pH value of the water that serious corrosion might be expected to occur in pipe lines. Although red water has been a frequent source of complaint, nevertheless some piping in the municipal system has been in service for over 90 years and shows no sign of pitting. However, in other areas nearby lines have had to be replaced in a relatively short time. In several instances pipe failures occurred not from internal corrosion but from attack by the surrounding soil which when moist is acid in character. This condition was overcome by external insulation with paraffin and asphaltic compounds. Peculiarly, some Oslo piping suffered from serious electrolytic corrosion from the tramway. Salt wastes from manufacturing operations were allowed to seep into the ground. Whenever the soil became moist the return current of the electric tramway system left the pipe through this electrolyte, removing metal at a rapid rate, and resulted in pipe failure. Wrapping and coating in a standard manner appears to have solved this problem.

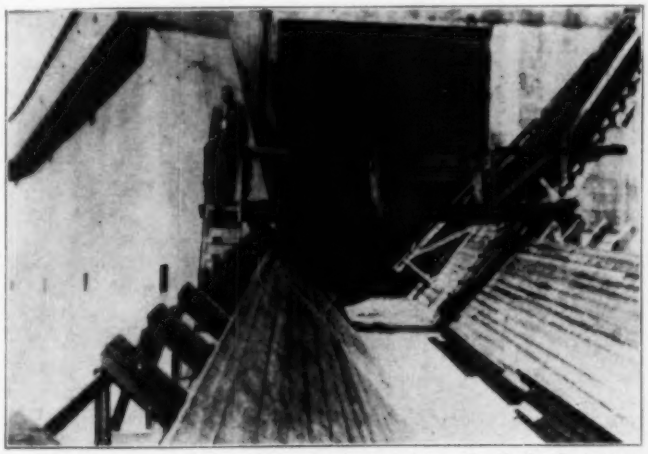
Of interest is the drawing (Fig. 2) which shows the sewer lines, water lines, electric lines and similar facilities all installed in the same trench. A break in the water line would mean failure of the electric power. During the German occupation, the life of the Utilities Director and his associates depended on having no power failures. As a result, in new construction work these lines have been separated into individual trenches.

"Hungry Waters"

The waters of Norway, with perhaps few exceptions, are "hungry waters" containing hardness of as low as 7 parts per million and are corrosive when transferred through steel pipe. The author was informed by Mr. Roll, Consulting Engr. and Contractor, that the problem has been attacked from several points of view. The corrective measures tried are: (1) "Calgon" treatment; (2) Installation of new asbestos-cement or cement lined pipe; and (3) cleaning and lining old pipe with cement or asphaltic compounds.

"Calgon" treatment is a relatively new practice and attempts are being made to obtain satisfactory control with the addition of as little as 2 ppm. to the water supply. Results to date are not conclusive but they are optimistic that reasonable protection may be obtained.

The asbestos-cement pipe is an English product which appears to be giving trouble-free service up to the present time. The lining of the old



SLUICE such as provided at all dams to release a minimum flow for log floating.

pipe follows the practice developed by one of our American firms, and is proving highly successful. In non-urban districts, the lining has proven to be more of a problem because of lack of manholes in which to carry out necessary operations.

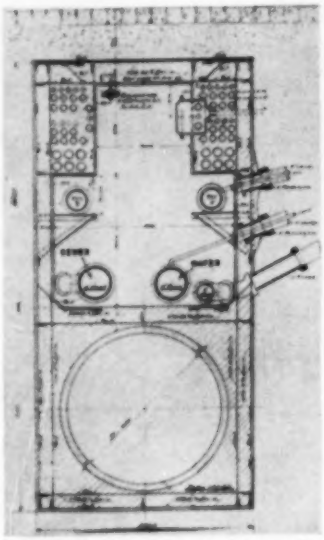
Lime addition also has been used to aid in corrosion inhibition, but most of these treatments now have been discontinued because the resulting benefits did not appear to justify the cost.

In general, all waters are low in turbidity, so low in fact, that coagulation requires the addition of clay to aid in the formation of good floc. Activated silica has been tried, but it probably was not given a fair trial and it was reported to the author that the results have not been too satisfactory.

In the few instances in which treatment of the raw water is necessary for industrial services, the matter of most concern is that of color removal. This is not too serious in the case of Oslo where the final color index is 20 parts per million which is not objectionable in a water glass because of the clarity of the water. In a bath tub the color is more noticeable. Some raw waters have color ranging as high as 150 parts per million.

Usually, the paper mills can use raw water with impunity, but in plants in which bleached paper is manufactured the specifications are becoming more and more strict just as in the United States and in the last stage of treatment it now is necessary to show less than 10 parts per million of color.

The author was informed by Mr. Roll, Consulting Engr. and Contractor, that possibly there are only ten water treatment plants in Norway in which they are justified in coagulating the water, using alum and lime. The other water supplies contain only a moderate color. A relatively large water treatment plant is located at Bergen, but most of the plants are small and highly trained operators cannot be made available. Often retired members of the fire brigade are trained to carry out the bare minimum of tests necessary to make the plants function. Recently, the Norwegian Department of Health has ordered widespread chlorination of the country's drinking water supplies, but because of the existing state of Norwegian finances and monetary exchange rates the purchase of such equipment in the United States is not possible. However, the only suppliers of chlorine equipment at present are United States vendors.



INTERESTING method of installation of electric, gas, water and sewer lines in common tunnels.

Boiler Water Conditioning Not Practiced

Boiler feed water conditioning as practiced in this country is not employed in Norway, since high pressure boilers are non-existent because of the general availability of water power and the relatively low total power load in the country. Should demand for power increase sufficiently to exceed the available hydro-electric generation, it probably would be necessary to build steam generating stations as has come to be required in the Tenn. Valley Authority region of our own country to supplement hydro-power.

The waters are low in dissolved constituents and silica removal, as practiced in this country, is not necessary. However, deionizing has been used in plants making heavy-water. Aside from a few such special services the Norwegians apparently are satisfied generally with existing water supplies.

Acknowledgement

The author wishes to express his appreciation to the following for their courtesy and helpfulness:

Engineer Hall and Mr. Beeholm, Chief Engineer of the Oslo Water and Sewage Works, who accompanied him during the inspection of the water treating and sewage facilities, and Director Rorvig who made the inspections possible. Mr. Roll, Consulting Engineer of Oslo, Norway, for his courtesy in making analyses available and in taking time to discuss the industrial aspects of Norway's waters.

[The next article in this series will discuss the water supply of Copenhagen, Denmark.—Ed.]

Two New Alloys Of Interest

At the recent Chemical Industries Exposition two new alloys were introduced.

Of interest to water and sewage works men, one of these new alloys is a combination of copper with lead to be marketed under the name copralium. The other is a combination of steel and lead to be known as ferroleum.

It is said that these new alloys combine the advantages of the three metals (copper, steel and lead) in strength, high electric conductivity and heat transfer values in addition to their superior resistance to attack by acids.

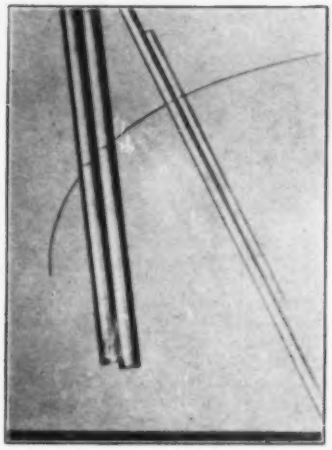
The two alloys were introduced by Knapp Mills, Inc., manufacturing under license from the American Viscose Corp.

Morris Cohn Now City Manager of Schenectady

Morris M. Cohn, longtime City Sanitary Engineer of Schenectady, N.Y., became City Manager of that city on January 1, 1952.

Mr. Cohn has been very active in obtaining stream pollution legislation for New York State and is presently serving as Chairman of the New England Inter-State Sanitation Commission. He has just recently had an active hand in securing a revision in New York State's municipal financing acts, which has now legalized sewage works financing through revenue bonds supported by sewer service charges. This new act permits municipalities to borrow money for sewage works financing without limitations imposed by legal bonding limits heretofore applying.

Mr. Cohn will continue as editor of "Wastes Engineering."



A Graphical Method For Determining Slopes of Curves

Glass Stirring Rods Used in Simple and Rapid Mechanical Technique

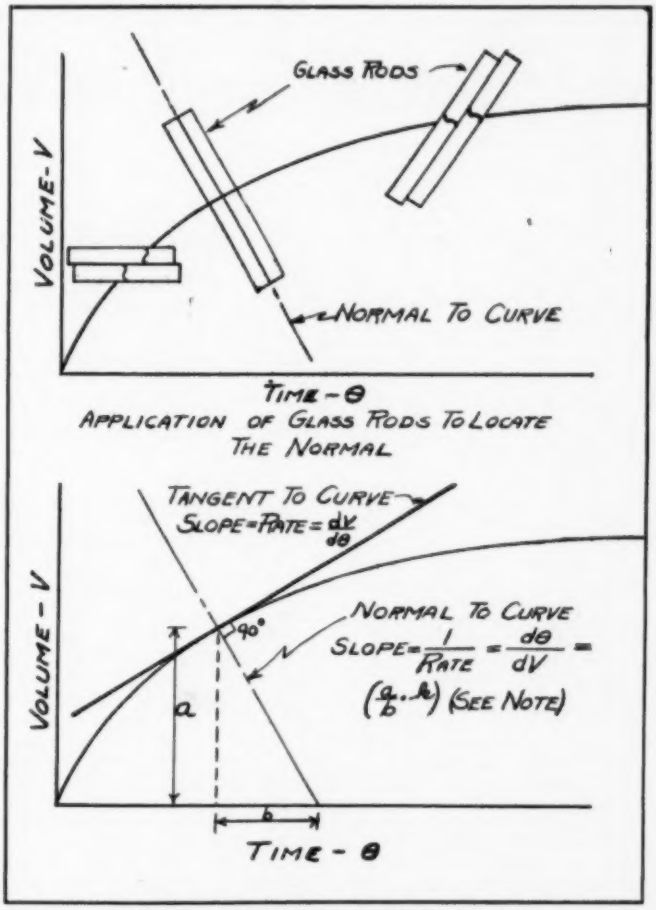
by E. ROBERT BAUMANN, *Research Assoc. in Civil Engineering, Univ. of Illinois, Urbana, Ill.*

ALMOST everyone who works with experimental data finds it convenient and necessary to develop short cuts or simplified methods for solving various problems. Many times such methods take the form of graphical solutions which would be of interest and assistance to others. Recently, such a method was used with considerable success in the Sanitary Engineering Laboratory of the University of Illinois for determining the slopes of curves at various points along the curves.

In conducting a recent study of the filtration of water through diatomite filters, it became necessary to utilize the data in the form of a plot in which the instantaneous rate of flow was plotted as ordinate against the volume of filtrate as abscissae. The data available for analysis consisted of records of the total weight of filtrate and the time required to collect that weight. The volume of filtrate was calculated and plotted on the ordinate against the time of filtration as the abscissa.

The slope of a tangent to the curve at any point represented the instantaneous rate of flow at the point of tangency. The slope of a normal (perpendicular) to the tangent represented the reciprocal of the instantaneous rate of flow. The rate of flow could have been determined mathematically from the equation of the curve and by the application of differential calculus. Actually, however, the normal at any desired point on the curve was determined mechanically, and its slope was determined graphically.

Two ordinary glass stirring rods touching along their length were placed on the point on the curve at which the instantaneous rate of flow was desired, so that the line of contact of the two rods crossed the curve at the given point. This is illustrated in the photograph at the head of this article. The curve will appear discontinuous under the glass rods, due to the differences in refraction of the glass, except when the rods are normal to the curve, at which time the curve as seen through the glass rods is continuous. The latter



GRAPHICAL DETERMINATION OF SLOPE OF NORMAL

Note—Use the factor "k" to correct for difference in scales (ratio of abscissa scale to ordinate scale.)

condition was achieved by simply rotating the rods around the given point of the curve. When the rods were properly positioned, the ends of their line of contact were marked on the graph, and the normal line was constructed. The slope of the normal expressed in units of time per unit volume was determined graphically as here illustrated. The instantaneous rate of flow expressed in units of volume per unit time could then be found by taking the reciprocal of the slope of the normal.

The method of finding the normal to a curve is easily applied to the mechanical solution of many problems. For example, the glass rods could be used to determine the tangent to mass curves in hydrology studies. The accuracy of the mechanical determination of the normal can be determined by using the glass rods to determine the center of a circle. Most users will be surprised at the speed and accuracy of the method.

Ohio River Commission Endorses Byrnes Bill

Todd Chairman of New Committee

To assist and encourage industries in the construction of waste treatment plants, the Ohio River Valley Water Sanitation Commission at its quarterly meeting in Cincinnati during January voted unanimous support for a change in the federal income-tax laws to permit a quicker write-off of costs incurred in the installation of such facilities. In so doing, the Commission endorsed the Byrnes bill (H. R. 5474) now before the House Ways and Means Committee of the Congress.

"If industries are given the opportunity to amortize costly waste treatment expenditures at an accelerated rate," said C. W. Klassen, chairman of the Commission, "we believe that this will provide an important incentive in promoting stream cleanup. The same idea is being successfully applied to encourage private enterprise in constructing defense plants. Since its formation in 1948 the Commission has been advocating a modification of tax laws for industries who must make substantial financial outlays for pollution abatement. In supporting the Byrnes bill, the Commission is reaffirming its position."

Other actions taken by the Commission included:

Adoption of sewage treatment requirements for the 150-mile Huntington-Cincinnati stretch of the Ohio River, which will be presented for public hearing at Huntington, W. Va., during the week of February 25.

Authorization of discussions with the U. S. Coast Guard in development of an inspection system to check on the nature and sources of pollutional discharges in the Ohio River, with particular emphasis on oil.

Extension of a contract with the Kettering Laboratory of Applied Physiology, Cincinnati, for the conduct of research on the toxicity of substances in water.

Authorization of $2,000 to supplement a fund being raised by the Commission's Coal Industry Producers Committee to promote research on control of mine-acid at the Mellon Institute, Pittsburgh. Heretofore, this project has been solely sustained by the Commonwealth of Pennsylvania.

Approval of a working arrangement with the U. S. Public Health Service, division of water-pollution control, to accelerate development of comprehensive-program reports on certain interstate streams in the Ohio Basin.

It was announced that a new committee composed of both municipal and industrial users of water from the Ohio River, previously authorized by the Commission, was now organized. Under the chairmanship of A. R. Todd, director of water purification, Wheeling, West Va., this committee will keep the Commission posted on pollution conditions by means of daily tests. This systematic monitoring of water quality is expected to provide important evidence for Commission control actions.

Barton A. Holl Appointed to Ohio Water Control Board

Barton A. Holl, president of The Logan Clay Products Company, Logan, Ohio, has been named to represent "business" on the Ohio Water Control Board created by recent passage of the Deddens Water Pollution Control Act.

The new five-man board, established within the State Department of Health, is composed of the directors of Health, Commerce, and Natural Resources, with two appointed members representing business and municipalities. This new authority has the power to conduct studies and develop programs of pollution control and abatement; full jurisdiction over permits for discharge of waste into State waters; plus means for enforcing its orders.

Based on his study and knowledge of the situation, Mr. Holl made the following comment:

"Today, our cities and factories place an impossible strain on the facilities we have for controlling water pollution. In this present state of emergency, such conditions are a dangerous threat to personal health and industrial production. We must get government and industry to cooperate in meeting this threat.

"Under existing laws, the primary responsibility for enforcing water pollution control rests with States. Yet, we must realize that the real responsibility for abatement rests on communities and industrial plants. There's a drastic need for more sewage and waste treatment plants, and a great deal of construction work should proceed immediately."

In addition to directing operations at The Logan Clay Products Co., Mr. Holl is president of the Bremen Telephone Co., vice president of The Logan Home Telephone Co., and vice president of the Logan Foundry & Machine Co.

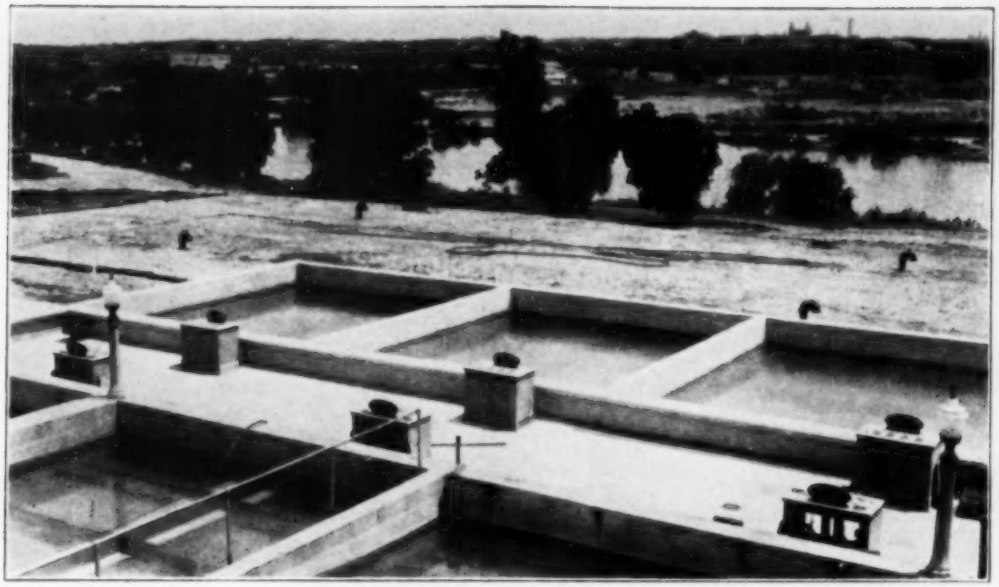
Jersey City Sewage Treatment Plants to Cost $26.5 Million

Plans have been completed for two sewage treatment plants to serve Jersey City, N.J., which will cost $26,500,000 and possibly more if construction costs continue to rise.

The plans have been drafted for the Jersey City Sewage Commission by Clyde Potts Associates of N.Y. City at a cost of $600,000 to date.

QUICK HENRY, The Hardy Cross Method! I'm betting that the brunette's glass will be empty before the blonde's.

YES PROFESSOR, but shouldn't we also consider the likelihood of some back-syphonage in this problem?



OUTSIDE FILTERS, the latest addition to the Austin plant

Water Treating Experiences

(The seventh of a series of articles)*

by A. H. ULLRICH, *Sup't., Water & Sewage Treatment, Austin, Texas*

IN earlier articles* the writer described some of his experiences in treating waters which are distinctly different in their degree of hardness. In each case he has given average or typical chemical analyses in order to show other distinguishing characteristics between the supplies. Since all the supplies dealt with have been surface supplies, the treatment in each case has included disinfection with chlorine or chloramines, coagulation, settling and filtration. Two of the supplies also require seasonal taste and odor control treatment; one supply requires pH adjustment for corrosion control and one supply requires lime softening. The present article is written in the hope that it will serve to summarize the writer's experiences and, in a manner, clarify some of his conclusions.

*Earlier articles of this series by Mr. Ullrich appeared in W. & S.W. for January, March, May and August 1950; January and July 1951.

Although typical chemical analyses of the three types of treated water were given in previous articles these are repeated in an accompanying table for purposes of comparison.

The Poteau River Supply Fort Smith, Ark.

As previously noted, Supply No. 1 at Fort Smith was abandoned because of frequent backing up into the Poteau, of waters, of Arkansas River which caried excessive chloride concentrations. During periods of such backwater the treated water varied in composition, depending on the composition of the two raw waters and on the percentage of each received at the intake. The bicarbonate hardness of mixtures of the two waters normally varied from 40.0 ppm to 110.0 ppm. The accompanying analysis of Supply No. 1 was typical of the treated water when only Poteau River water was received at the intake. Very infrequently the treated water bicarbonate hardness of the Poteau supply dropped as low as 10 ppm. but normally it remained nearer the 40 ppm. shown.

From the above it is seen that, for long periods, Supply No. 1 carried sufficient bicarbonate hardness to cause some scale formation in hot

	Supply No. 1	Supply No. 2	Supply No. 3	
	Treated Poteau River Water Fort Smith, Ark. 1931	Treated Lake Fort Smith Water Fort Smith, Ark. 1938	Treated Colorado River Water Austin, Texas 1948	1949
Silica (SiO_2)	6.2	4.3	8.4	5.4
Iron (Fe)	.01	.04	0.0	0.0
Calcium (Ca)	21.0	10.0	12.0	12.0
Magnesium (Mg)	3.6	1.5	11.0	12.0
Sodium (Na)	5.7	1.4	38.0	38.0
Potassium (K)	2.6	1.2		
Boron (B)			0.18	0.21
Carbonate (CO_3)	0.0	4.0	25.0	25.0
Bicarbonate (HCO_3)	40.0	16.0	11.0	0.0
Sulphate (SO_4)	39.0	12.0	30.0	33.0
Chloride (Cl)	6.8	4.5	49.0	54.0
Nitrate (NO_3)	.94	1.4	0.8	0.5
Fluoride (F)			0.2	0.2
Dissolved Solids	109.0	51.5	182.0	196.0
Total Hardness	78.0	36.0	75.0	79.0
pH	7.2	8.6	9.8	10.2

water heaters. When this supply was in use there were very few complaints involving failures of galvanized tank type heaters but there were occasional complaints involving stoppages of instantaneous, (copper coil) type heaters. This water caused some tuberculation in cast iron mains but it was not aggressively corrosive to the point of causing red water complaints. Except during periods of very high turbidities the raw water was easily coagulated, there being sufficient alkalinity to provide adequate buffering action.

The Lake Ft. Smith Supply at Fort Smith.

The typical analysis of Supply No. 2 represents Fort Smith's present lake supply. As noted, this water is low in bicarbonate and carbonate hardness and low in dissolved solids. When Fort Smith first changed from Supply No. 1 to Supply No. 2 an attempt was made to continue the use of alum in the same manner as it had been used. It was found that since the lake water is low in alkalinity and has little buffering action, it necessitates coagulation at low pH values. Therefore, within a very short period after the change in supply was made, there were numerous complaints regarding red water, both in cold and hot water systems. The treating method was then changed to permit pH adjustment to any desired value. However, it was found that, with this soft water, pH values in excess of 8.8 removed galvanizing and actually *increased* the corrosion rate by dissolving the zinc coating from galvanized pipe and hot water tanks. Subsequent studies indicated that a treated water in the restricted pH range of 8.3 to 8.6 would not be detrimental to galvanizing and would eliminate red water complaints in cold water piping. Treating the water in this manner did not, however, protect galvanized tank hot water heaters. Consumers were therefore advised to protect their galvanized tank hot water heaters with "Micromet"—a form of "Calgon". An attempt was also made to encourage the installation of corrosion resistant type heaters in all new installations.

The Colorado River Supply at Austin, Texas.

The accompanying two typical analyses of Supply No. 3 represent the present Austin treated water. As noted, after lime softening, the water has a total hardness of about 79 ppm., of which approximately 50 ppm. is carbonate hardness. The treated water pH ranges from 9.8 to 10.2, with the normal being near 9.8 on the pH scale. The treatment is purposely adjusted so that the filtered water is faintly incrusting in nature. Past experience indicates that the calcium carbonate deposition in cold water systems is just sufficient to protect cast iron and galvanized piping. New galvanized pipe seems to be attacked at first but apparently the calcium carbonate deposition is rapid enough to stop zinc removal before actual damage is done. In some sections of the distribution system the incrustation has a rough surface so that the value of C is, no doubt, lowered considerably. It is now the writer's unproven opinion that this roughness is, in a measure, due to the beginning of tuberculation before sufficient calcium carbonate can be deposited to properly protect the cast iron. Generally, the deposit appears to be smooth in sections where there is sufficient movement of water to maintain a slight instability until a protective coating has been formed. Red water complaints are almost unknown and those that are received can be traced to abnormal conditions such as electrolysis or galvanic action. In hot water systems, where the greater part of the calcium carbonate is removed in the heater, the hot water piping is subject to more rapid deterioration. However, very few complaints regarding excessive corrosion, even in hot water piping, are received. In such cases the conditions are usually abnormal. There are occasional complaints involving excessive deposition of calcium silicate in the hot water piping leading from large hot water heaters. The most severe cases seem to involve circulating hot water systems. Usually, the deposit is worst near the heater and is not excessive twenty or more feet beyond the heater outlet.

IDEAL PROTECTION is that represented by this smooth egg-shell coating of calcium carbonate laid down from properly treated water.

Conclusions Regarding the Corrosive Tendency of Various Waters.

While it is not the purpose of this article to discuss the theory of corrosion as applied to water systems, it may be helpfull to list the following important facts concerning the corrosion of iron:

1—At atmospheric temperatures, iron will not corrode in the absence of water or moisture. Therefore, if we can provide a coating or lining which will prevent water from reaching the iron surface we can definitely protect iron. Linings which have been used with some success include zinc (galvanizing), bitumastic enamels, other enamels, cement, paints, and glass. Coatings or linings formed by chemical reaction within the water which have been used include calcium carbonate, silicates and phosphates.

2—All waters have a tendency to corrode iron. This tendency, as a rule, is greatest in acid or low pH waters and lowest in alkaline or high pH waters. It is the writer's opinion that in the treatment of potable waters the pH cannot ordinarily be increased sufficiently to give adequate protection by this method alone unless it is accompanied by the deposition of a protective coating.

3—Free carbon dioxide and other acids increase corrosion, both by increasing the corroding tendency of iron and by dissolving protective coatings.

4—Very high pH or alkaline waters reduce the corroding tendency but if the pH is excessive it may attack lead and prove destructive to protective coatings such as zinc galvanizing; and, thereby, actually increase corrosion in such systems.

5—Dissolved oxygen or other oxidizing agents must be present in any except acid waters to support continuing corrosion. Also, the rate of corrosion depends on the oxygen concentration and on the rate at which it is replenished. Even the very soft Lake Fort Smith water was not aggressively corrosive when the dissolved oxygen concentration dropped to, or below, 6.5 ppm.

It is the writer's opinion that excessive chlorine residuals may supplement dissolved oxygen in increasing corrosion rates.

6—Dissimilar metals in contact with each other and with water will cause corrosion by galvanic action; thus, brass or copper in contact with iron will cause the iron to corrode. Even two different types of iron in contact with each other may cause galvanic action.

7—Direct electric current passing from iron into water and out again will cause the iron to corrode. The grounding of certain electric appliances, especially those which use rectifiers or direct current, to water pipe may cause this type of corrosion.

8—High temperatures will increase the rate of corrosion.

9—High water velocities tend to increase corrosion by sweeping away the hydrogen film and by increasing the supply of dissolved oxygen reaching the surface of the iron.

10—The solution or corroding tendency of iron may be neutralized by application of a counter acting voltage. This is accomplished in practice by the use of cathodic protection. Cathodic protection may involve either the use of a counter direct current or an expendable metallic anode.

11—It has been the opinion of some that high sulphate and possibly high chloride concentrations cause higher corrosion rates.

12—It has also been the opinion of some that soft waters are inherently more corrosive than hard waters. It is possible that high calcium and high carbonate concentrations tend to produce complex iron salts with corrosion products to form better protective coatings than do the less complex iron oxides.

From the studies made on the two Fort Smith supplies and the Austin supply described above, the author has drawn the following conclusions regarding corrosion in municipal water supplies:

1—That the ordinary galvanized tank hot water heater with brass, tin or copper down pipe and brass thermostat will destroy itself through galvanic action if used with a soft, non-scale forming water. Tests made on such a tank which had been in service about eighteen months with the soft Lake Fort Smith water showed that approximately six milliamperes of current flowed between its tin down pipe and the heater shell. In the same tank the current which flowed between the brass thermostat and the heater shell was approximately five milliamperes.

2—That for a galvanized tank hot water heater to give reasonably satisfactory service it should be used with a water which has sufficient carbonate or temporary hardness to form a protective scale, with a water which is purposely treated to form a protective coating on all interior parts of the heater or with a water which is extremely low in dissolved oxygen.

3—That treating a *low* calcium and low carbonate water to calcium carbonate stability with lime is not sufficient to form a protective coating in hot water heaters and piping. If calcium carbonate stability can be reached only by treating to a high pH then there is not sufficient calcium carbonate present to form an adequate coating.

4—That the excess lime treatment in lime softening, if not carefully controlled, may be detrimental to galvanized tank hot water heaters and to galvanized hot and cold water piping. It is likely that if the water is treated to a very high pH and the high pH is maintained in the finished water, the calcium carbonate solubility is depressed below the point where it can form an adequate protective coating. This factor may cause difficulty in some cases where magnesium removal is a requirement of lime softening. In such cases the excess lime treatment may reduce the calcium and carbonate concentrations below desired values even when recarbonation is practiced.

5—That waters which have sufficient calcium bicarbonate hardness form adequate protective coatings in tank type hot water heaters through their deposition of protective scale. That where lime softening is practiced, if it is possible to retain a slight instability in the treated water, such water may form an adequate coating to give reasonable protection to both tank type hot water heaters and cold water piping.

6—That with very soft waters, excessive pH values are harmful. With Lake Fort Smith water a pH of 8.8 was found to soften galvanizing. Higher pH values were found to remove it and expose the iron. It is the writer's opinion that the excess lime treatment in water softening, where adequate recarbonation or some other corrective treatment is not practiced, may result in similar results, even though the treated water approximates calcium carbonate stability.

7—That excessive temperatures will accelerate corrosion.

8—That deaeration or oxygen removal will aid in reducing corrosion in both hot and cold water systems. This has long been practiced in boiler plants and other industrial installations. It has not been found practical to deaerate or practice oxygen removal on a large scale in treating municipal supplies.

9—That silicate treatments when properly supervised may form adequate protective coatings to reduce corrosion. This has been practiced in large hot water systems.

10—That copper coil instantaneous heaters and copper lined and monel metal tank heaters are successful with soft, non-scale forming waters. Some reports on glass lined tank heaters have also been encouraging. Copper coil heaters may not be too successful with high calcium bicarbonate hardness waters due to excessive clogging.

11—That low dosages of sodium hexameta phosphate (1.0 ppm. or less) will not protect hot water systems when used with a low calcium and low carbonate water which contains considerable dissolved oxygen. That dosages of 5 ppm., or more, may give protection under these conditions.

12—That glassy phosphates, such as "Micromet," will give protection when used in adequate dosages.

13—That the use of dissimilar metals should be discouraged, especially in hot water systems using non-scale forming water. The use of brass faucets in contact with galvanized piping will often cause corrosion (red water) in both hot and cold water systems. It is believed that the quart or so of red water which is frequently obtained from a faucet which has not been in use for several days is the result of galvanic action between brass in the faucet and iron in the pipe with which it is in metallic contact.

In concluding this series of articles on his experiences, the writer wishes to emphasize the fact that each water is an individual problem. For satisfactory solutions, we must study the characteristics of each water and then attempt to design the treatment best suited to our customers' needs.

Basic Factors

In Preparing a Centrifugal Pump Inquiry

by ROY CARTER *and* IGOR J. KARASSIK, *Application Engineers*
Worthington Pump & Machy. Corp., Harrison, N.J.

In our January, 1952 issue, authors Carter and Karassik completed a series of six articles dealing with "Basic Factors in Centrifugal Pump Application." The series which began in our January, 1951 issue extends beyond the mere term "application," since operation efficiencies, performance, and to a lesser extent maintenance, are also discussed.

In this new series of three articles the same authors have been asked to cover the "Basic Factors in Preparing a Centrifugal Pump Inquiry." In this series are to be discussed the most essential data needed to intelligently select a centrifugal pump of proper type, design and operating characteristics for the conditions under which it is to operate.

Unless the pump bidder is supplied with such essential data it is impossible to make certain that the pump offered the purchaser will give minimum trouble, in operation and maintenance, and perform with a high degree of efficiency in power economy during a long life of non-obsolescence.

A careful study of these three articles is recommended to every prospective centrifugal pump purchaser.

IN order to achieve a satisfactory selection and application for a contemplated centrifugal pump installation it is highly essential to make a careful analysis of all the factors pertaining to it. It should be understood that it is impossible to present a complete survey of all these factors and therefore, experience and intimate contact with such installations are the only practical guides to a complete knowledge of the subject. Nevertheless, it is possible to outline the most essential data required to make an intelligent selection of a centrifugal pump for any given installation. Facts concerning these data should be ascertained before the inquiry for the centrifugal pumping equipment is prepared.

The essential data required to make a comprehensive analysis are summarized in Table I and are discussed more fully below, in the order in which they are listed.

1—Number of Units

As it will be seen presently, hydraulic conditions may in certain cases dictate the number of pumping units required to meet the total requirements. Nevertheless, the number of units selected for a given installation is primarily affected by reliability considerations. Thus, standby units are frequently necessary in order to prevent a dangerous interruption of service, or in cases where the life of the pump may be jeopardized by the severity of the service.

The choice between the use of a single pump for a given application and the installation of several pumps in parallel for the full demand is generally influenced by the nature of the expected load factor. When the demand is more or less constant, the tendency is to select a pump for the full capacity corresponding to the maximum demand, adding a slight margin as provision against pump wear. If, on the other hand, the load is of a fluctuating nature, two or more pumps may be operated in parallel. At periods of light load, one or more of the pumps can be taken off the line for more economical operation, since the remaining pumps will share the load at a more efficient capacity. It goes without saying that whenever two or more pumps are intended for parallel operation, this fact should be made known, as the hydraulic performance of the individual units may need to be made suitable for operation in parallel.

The capacity of individual pumps is frequently selected with the view towards economy of operation at the loads most frequently encountered. For instance in the event that the demand remains at 65% of the maximum capacity most of the time, two pumps, each designed for about 70%

Table I

SUMMARY OF ESSENTIAL DATA

REQUIRED IN SELECTION OF CENTRIFUGAL PUMPS.*

1—NUMBER OF UNITS REQUIRED

2—NATURE OF THE LIQUID TO BE PUMPED
Is the liquid:
(a) Fresh or salt water, acid or alkali, oil, gasoline, slurry or paper stock?
(b) Cold or hot and if hot, at what temperature? What is the vapor pressure of the liquid at the pumping temperature?
(c) What is its specific gravity?
(d) Is it viscous or non-viscous?
(e) Clear and free from suspended foreign matter or dirty and gritty? If the latter, what is the size and nature of the solids, and are they abrasive? If the liquid is of a pulpy nature, what is the consistency expressed either in percentage or in lb per cubic foot of liquid? What is the suspended material?
(f) What is the chemical analysis, pH value, etc? What are the expected variations of this analysis? If corrosive, what has been the past experience, both with successful materials and with unsatisfactory materials.

3—CAPACITY
What is the required capacity as well as the minimum and maximum amount of liquid the pump will ever be called upon to deliver?

4—SUCTION CONDITIONS
Is there:
(a) A suction lift?
(b) Or a suction head?
(c) What is the length and diameter of the suction pipe?

5—DISCHARGE CONDITIONS
(a) What is the static head? Is it constant or variable?
(b) What is the friction head?
(c) What is the maximum discharge pressure against which the pump must deliver the liquid?

6—TOTAL HEAD
Variations in items (4) and (5) will cause variations in the total head.

7—Is the service continuous or intermittent?

8—Is the pump to be installed in a horizontal or vertical position? If the latter—
(a) In a wet pit?
(b) In a dry pit?

9—What type of power is available to drive the pump and what are the characteristics of this power?

10.—What space, weight or transportation limitations are involved?

11—Location of installation.
(a) Geographical location.
(b) Elevation above sea level.
(c) Indoor or outdoor installation.
(d) Range of ambient temperatures.

12—Are there any special requirements or marked preferences with respect to the design, construction or performance of the pump?

*NOTE: The first three items are covered in detail in this article. The balance will be covered in Part II of this series.

of maximum flow, could be installed. Thus for the greater portion of the time one pump alone would be able to carry the load. When the total required flow exceeds 65% of maximum, the second pump is put on the line, both pumps sharing the load and operating in parallel.

There may be exceptions to this general practice:

(a) When the total capacity is too low to be split up efficiently between two pumps, a single pump may have to be used, regardless of the nature of the load factor.

(b) When the maximum capacity is too great to permit the use of the most efficient pump or of the most economical operating speed, the capacity may be split up between two or more units, again regardless of the nature of the load factor.

(c) When the efficiency of operation is inconsequential—as when the service is very intermittent or when the pumps are turbine driven and use is made of the exhaust steam for process work or for heating. In this or similar cases first cost will generally determine the number of pumps to be used in the installation.

(d) To insure reliable operation under all condititons, it is the practice for some specific services where interruption or reduction in flow must not occur, to use two pumps for a given installation. Each pump is designed for the total maximum demand, with both operating in parallel at all times, even for part loads. The advantage of such an arrangement is that should one of the pumps become inoperative for any reason, the remaining unit can take up the full load by itself. There is however, a definite disadvantage to this scheme, in that it involves the constant operation of the pumps at capacities under 50% of their actual design conditions. Such operation generally shortens the overall life of the pumps, in addition to reducing the operating efficiency of the installation. A further disadvantage is that the head generated by a pump operating at 50% of its design capacity and below, is greatly in excess of the required pressure and, therefore, this excess pressure must be throttled if the pump is operating at constant speed.

If more than one pump is used to provide the maximum demand and if a partial reduction in available capacity is permissible, the installation may not require a spare pump. In such a case, sufficient spare parts must be kept on hand to effect a rapid restoration of full available capacity. If, however, no reduction in available capacity can be permitted, it becomes necessary to provide a spare pump

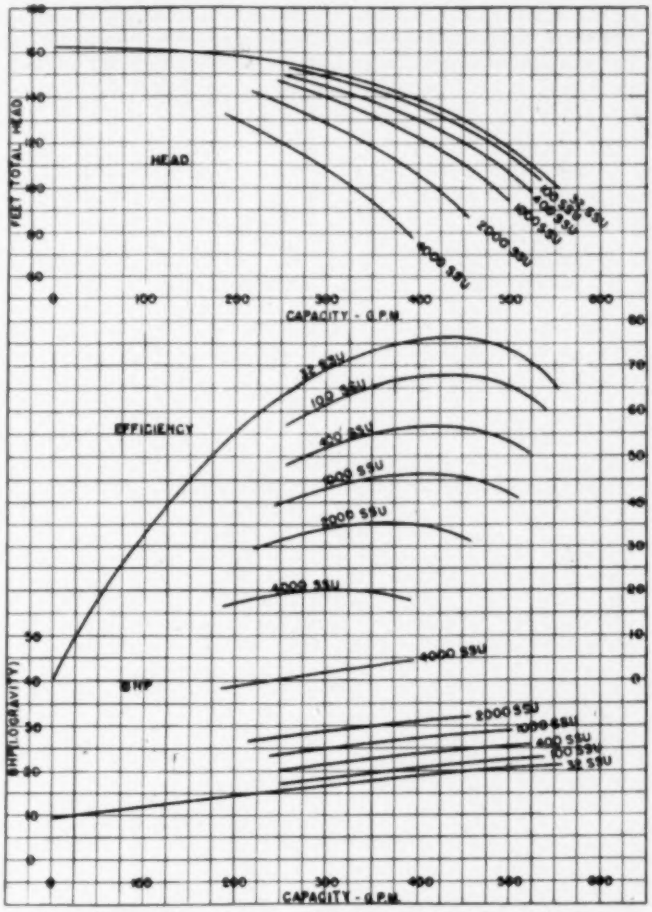


Fig. 1—Effects of change in viscosity of liquids on centrifugal pump performance.

which can be put into service immediately upon failure or stoppage of one of the pumps. Since this substitution must provide against the interruption of the prime mover as well as for pump failure, it is the general practice to use a different source of power to drive the spare pump. Thus, if the normal operation is based on motor drive, the spare pump would be driven by an internal combustion engine or a steam turbine. The switch-over to the spare pump can be accomplished automatically in any one of several manners. The impulse for the controlling mechanism can be, for instance, the interruption of current in a solenoid operated pilot valve or the decrease of pressure in the discharge header.

2—Nature of the Liquid Pumped

(a)—The nature of the liquid pumped immediately determines to a certain extent the types of pumps most frequently used for the service involved. Naturally, the widest range of selections is available for water service, but even this can be broken down into fresh and salt water. The selection of materials for the latter service varies greatly from the point of view of first cost, length of life and customer's preference and experience. Apparently insignificant impurities in the liquid comprise a highly important factor in the selection of the proper materials. In the same manner, the nature of the liquid to be pumped will affect to a great extent not only the materials of the pump, but possibly even the mechanical construction best suited to the purpose, depending on whether the liquid is an acid, alkali or oil. For example, if the pump is to handle highly corrosive liquids, not only will the pump be built of corrosion-resisting material, but means must be made

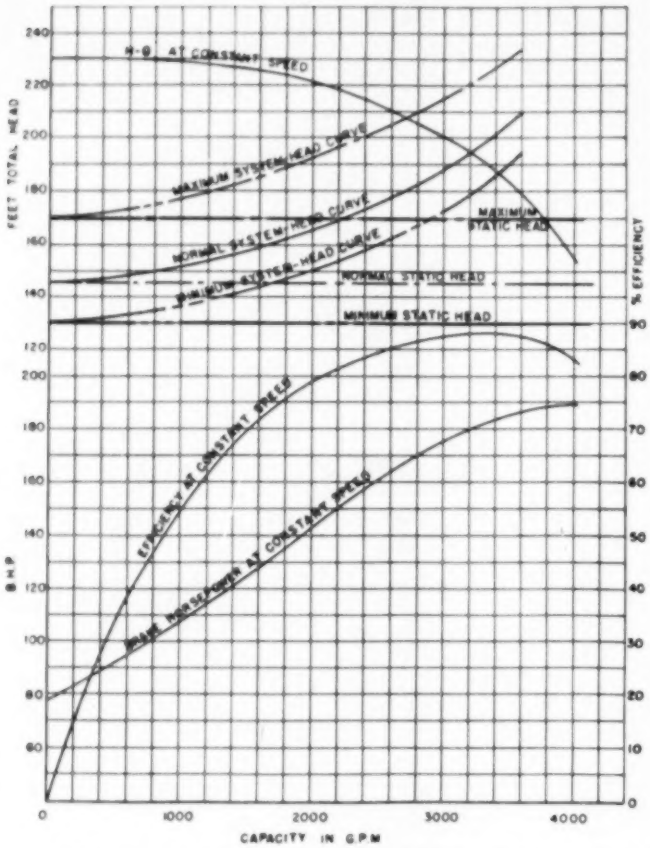


Fig. 2—The effects of changing static and overall head on pump capacity.

available to avoid leakage of the liquid out into the atmosphere through the stuffing box.

(b)—The temperature of the liquid to be handled is a *very* important factor. Obviously, pumps from a standard line of general service pumps have definite temperature limitations, so that higher temperatures immediately predicate the necessity of special materials, water cooled stuffing boxes or special mechanical features such as centerline support of the casing. Likewise, when extremely low temperatures prevail, such as in refrigerating brine service, the addition of nickel has been known to increase the impact resistance of cast iron at these temperatures.

Any wide variations in the operating temperatures should also be known, as they will affect the specific gravity and viscosity range of the liquid in question.

If the liquid in question is water, the vapor pressure at any given temperature can be easily determined from steam tables. If however, some other liquid is involved it is necessary that the vapor pressure at the pumping temperature be carefully noted, since it figures importantly in determining whether or not the prevailing suction conditions are satisfactory.

(c)—The specific gravity of the liquid to be handled must be known in order to determine the power consumption at the design conditions and to select the proper driver size. Furthermore, a pump inquiry frequently expresses the required discharge or net pressure in pounds per square inch, which must be converted into feet of the liquid handled at the temperature involved.*

(d)—When the viscosity of the liquid handled differs from that of water, the pump capacity, head and power consumption are all affected appreciably, so that correction factors must be applied by the designer to meet the required performance conditions. The effect of viscosity on pump performance is illustrated on Fig. 1, showing the performance of a specific centrifugal pump operated at constant speed and handling liquids of varying viscosity. The graph reveals that, with increasing viscosity pumping head and efficiency decrease for a given capacity.

(e)—The size and nature of the solids suspended in the liquid pumped will determine both the type of impeller best suited for the purpose and the materials to be used for pump construction. If the solids are very abrasive, an open impeller is generally used and, where the nature of the pumping job warrants it, special and more expensive wear-resisting materials may be applied. When solids reach a certain size, or are of a stringy nature, special non-clogging impellers, as used for sewage service, are required. An impeller of the open non-clog type is shown as Fig. 3.

(f)—Special consideration should be given to the chemical components of the liquid if its corrosive or electrolytic properties are not readily apparent from the description of the liquid itself. Thus, pH of the water, which is a measure of its acidity or alkalinity, should always be stated if indications exist that the water is not neutral.

3—Required Capacity

The capacity required for the installation should be stated in U.S. gallons per minute at the pumping temperature. Any desired or imposed variation in the range of capacities should be clearly stated. It must be remembered that centrifugal pumps do not permit as great a flexibility in capacity variations, without affecting pump efficiency, as the reciprocating steam pump. Furthermore, it is gen-

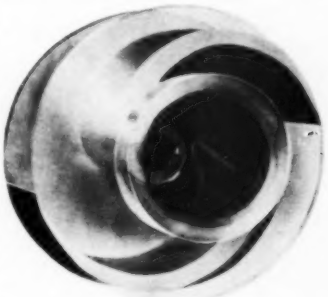


Fig. 3—Phantom view of the open non-clog type of impeller required when the liquid contains large solids or stringy materials—this one a typical sewage type impeller.

*For conversion of pressure to feet of liquid, see "Basic Factors in Centrifugal Pump Application—Part I," by Messrs. Carter and Karassik, *Water & Sewage Works*, January 1951.

erally preferable to have the maximum efficiency of the pump occur at or near the normal capacity conditions. For instance, whenever the total head against which the pump must work includes a static head which varies considerably and the pump operates at constant speed, the capacity at which the pump will operate will also vary considerably as illustrated in Fig. 2.

While any centrifugal pump can run occasionally at a capacity considerably in excess of its rated capacity, this may not always be practical or permissible. The fact that an increase in capacity means a decrease in the head generated may prevent operation of the pump at emergency overloads if excess capacity was not included in the design and if the pump operates on a system head curve. This is so because the friction losses which make up part of the required head will increase with the capacity. Again, emergency over-capacity pumping may be prevented if the prevailing suction conditions leave no margin over those required for the normal rated capacity. Finally, if the power consumption increases with the capacity, as it does with the majority of centrifugal pumps, operation at capacities greater than originally expected may seriously overload the pump driver. Information as to the minimum capacity which may be encountered in operation is also of great importance. In certain cases, operation at extremely reduced capacities even for very short periods, presents a definite danger and means must be provided in the installation to avoid this. In other instances the only disadvantage accruing from operation at reduced capacities is poor economy and a thorough analysis of the problem may result in the installation of additional small units which would be operated during periods of light loads.

The next article in this series will discuss the important effect of suction and discharge conditions, load factor, preferred axis or rotation, characteristics of driving power, space, weight and location limitations and other special requirements on the selection of the proper centrifugal pump for any given application.

An Unusual Water Tank*

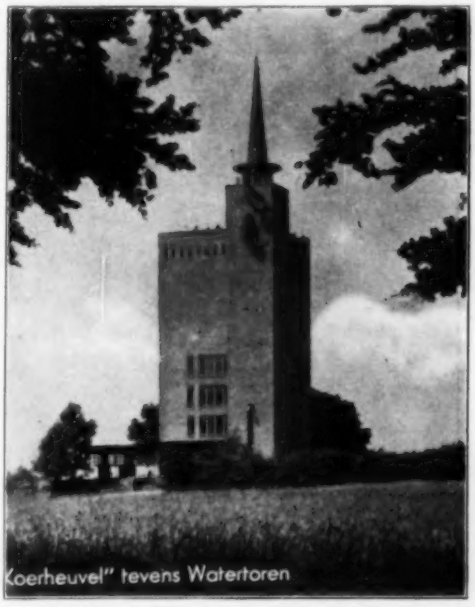
And, a More Unusual Tank Tower

When going abroad last summer, I decided that—for once—the trip would not be a "bus man's" holiday. No visits to water, sewage or waste treatment plants, no attending any kind of meetings, conferences or gatherings to talk shop—strictly a pleasure trip this time. I stuck to my intention, but in doing so had the unique experience of living for a week or more underneath a water tank, serving the needs of a community, and found the experience a very pleasurable one.

When the town of Rhenen (Gelderland) in the Netherlands required a new water storage tank the president of the water company conceived the idea of utilizing the advantageous hill-top site chosen for the water tank also as a location for a first class hotel. The combination of hostelry and water tower is here pictured. The rooms are good, food and drink excellent, and prices comparatively low.

The town of Rhenen obtains its water from deep wells located near the river Rhine. The water is soft and, after adding iodine, it is pumped up to the windowless section of the hotel which encloses the 200,000-gallon storage tank. An observation platform, reached by an elevator, is placed on top of the tank, allowing a superb view of the Rhine Valley. Above the observation platform is a steeple containing the machinery for the elevator. In the basement of the hotel is located the pumping station.

*Contributed by Dr. Willem Rudolfs, Rutgers University.



During the evening this unusual dual purpose structure is flood lighted and, being situated on a hill, serves as a beacon for many miles.

Water Project Costs Rise —The Project Doesn't

Progress by the city of Cudahy, or lack of it, in applications for permits to build a filtration plant and elevated water storage tank practically tells the story of inflation.

The city first applied to the state public service commission at Madison for a permit in 1947, estimating that the plant would cost $300,000 and the half million gallon tank, $70,000.

The PSC granted the permit, but said it must be used within a year. Cudahy received a couple of extensions, but on one application, in December, 1949, the PSC told the city to come back after a scheduled referendum was held on the subject.

At that time, the estimated cost of the project had gone up to $650,000 for the project.

The referendum was favorable, so Cudahy made another application in December, 1951. The commission, in a decision released Monday, again gave a permit good for a year.

The latest estimated cost: $900,000 —$684,600 for the plant, $102,500 for the tank and the rest for engineering and legal work.

Look Twice!

It is well to follow a leader, but it is wise to make certain that the leader is going the right way.

More on Weather Cycles and Their Causes

Offer of delayed booklet on this subject now renewed.

by HALBERT P. GILLETTE*
San Marino, Calif.

SEVERAL years ago readers interested in weather cycles were told that a booklet on the subject would soon be printed, and that a copy would be sent on request. Type for it had been set when I decided that the essay could be considerably improved by additional research, notably as to causes of cycles, as well as to lengths and dates. It turned out that this was a much greater task than expected. Also other matters engaged more of my time than had been anticipated.

The necessary analyses of data and "field surveys" of geological evidence of climatic cycles have been completed. The original offer of a copy of the booklet to any reader is now renewed.

Those who have seen my articles on Cycles during the last 24 years will have a general idea of the forthcoming essay. But its treatment of the causation of cycles will contain much that has not been printed; for example, how ionostreams are generated in the sun, and how they are "focused" on planets by the magnetism induced in them. Explanation will be given of how the Earth reacts upon the sun by drawing many solar ionostreams toward one another, causing sunspots that generate more ionostreams. This theory leads to an understanding of how two planets in the same heliocentric longitude (in conjunction) cause an abnormal number of solar ionostreams that tend to increase rainfall by their generation of atmospheric currents.

Another reason for prolonging this research was my attempt to show that certain long climatic cycles are due to unseen planets, or if seen not recognized as planets. Uranus, whose orbital period is about 84 years, was seen 17 times (the first in 1690) before it was recognized in 1781 as a planet. Its slow motion had let short visions of it to be regarded as light from a star. William Herschel finally discovered a slowly moving object that he thought might be a comet. A few weeks observation disclosed that its orbit was nearly circular, and he announced a new planet some 19 times farther from the Sun than is the Earth.

As stated in an article in 1941, I found that several planets tended to cause either sunspots or rainfall or both when they were close to heliocentric longitude 290°, presumably when they were in a fixed stream of ions (electrified corpuscles). At first I thought this ionostream flows sunward from the region of the zodiacal constellation Sagittarius. Later I found evidence that it issues from the sun. Among the planets that had thus caused a rainfall cycle were distant Uranus and Neptune. So it occurred to me that I might find that certain long climatic cycles were caused by unrecognized planets; and, if so, their longitudes could be determined.

As far back as 1880 a Scotch electrical engineer, Prof. George Forbes, had predicted that a planet might be found moving in a nearly circular orbit about 100 times as far from the Sun as the Earth. If so, according to Kepler's third law, its orbital period would be about 1000 years. He based this estimate on the fact that certain comets had their calculated aphelia (extreme distances from the sun) about 100 times as far from the Sun as the Earth is. He knew that each of the four giant planets has a "family of comets" whose aphelia are close to the nearly circular orbit of the planet. Therefore, since there was another "family of comets," it probably indicated a "parent planet."

In 1890, a French astronomer, N. C. Flammarion, using Forbes' theory, predicted a planet of about 320-year period. In 1928 an American astronomer, W. H. Pickering, estimated its period to be about 333 years.

I knew that the late Prof. J. A. Udden of the University of Texas had found, in a diamond drill core, evidence of a cycle of petroleum deposition of about 340 years. The drill core contained annually deposited laminae, called varves. Udden found about 340 varves between centers of black carbonaceous deposits. Since petroleum is of vegetable (planktonic) origin, that 340-year cycle to me meant a climatic cycle.

I finally got around to analyzing lake varves and tree rings in search of a cycle in their thickness that would be between 330 and 340 years. It turned out to be 336 years, apparently just four times the orbital period of Uranus. What led me to think that this planet A and Uranus are harmonic in their revolutions was that the maxima of the rainfall cycle caused by planet A occurred close to every fourth maximum of the Uranus cycle.

Using Forbes' theory, Pickering (1928) inferred a planet having a 656-year period. So I next applied my rain cycle theory to that problem; and eventually found a climatic cycle of 672 years, or double the 336-year cycle due presumably to a planet B.

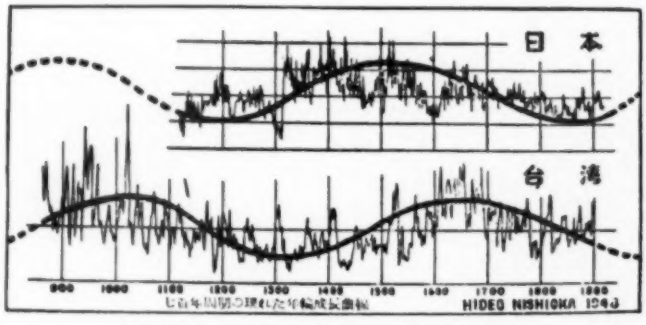


Fig. 1—Tree-ring Growth in Formosa, 860 to 1900 A. D.

*Member Am. Soc. Civil Engineers.
Editor Emeritus, *Water and Sewage Works*.

A and B caused cold maxima in 1658, the year that the Baltic Sea between Sweden and Denmark froze so solid that Swedish cavalry by crossing on the ice surprised the Danes and conquered them. The only other instance of such prolonged low temperature in that region was in 1323, which is too close to the previous due-date of a wet-cold maximum of the 336-year cycle to be accidental.

Inferentially there was a heliocentric conjunction of planets A and B in 1658 when both were about longitude 290°.

Since all four of the known giant planets have nearly circular orbits close to the plane of the Earth's orbit (through the ecliptic), and since out of the ten known planets only those four giants have families of comets, I infer that A and B are giant planets, with nearly circular orbits close to the ecliptic plane. If so A and B should be easy to find telescopically. Because of the much greater amplitude of the cycle that it causes, I would search first for B. It should now be near heliocentric longitude 87°.

The November 1951 issue of *Cycles* (9 East 77th St., N.Y. City) carried the accompanying graph, (Fig. 1.)of a cycle in Formosa tree-ring thicknesses that shows the 672-year cycle in a striking manner. The author of that article is Prof. Hideo Nishioka of Keio University in Tokyo. He calls the cycle's length 700 years, but the measured rings covered only 1040 years from about A.D. 860 to 1900. The black median curve indicates rainfall peaks about A.D. 1000 and 1650 and a valley about 1320. Data covering only 1.5 lengths of a cycle can not give either the peak or valley dates with accuracy.

The California Sequoia ("big tree") rings that I analyzed go back to about 1300 B.C.; but, due to frequent inversions of phases of rainfall cycles in that region, this cycle is not as outstandingly shown in them at any time as it is in the Formosa rings.

The most striking evidence of this cycle that I had published is in paired beds of white calcareous mudstone and black shale (Fig. 2.) which was printed in *Water and Sewage Works*, March 1950. There are 32 pairs of these rock strata in this locality near Los Angeles, and they average 4.5 feet thick per pair. The annual varves measured at that time averaged 11 to the inch, indicating that the cycle was about 600 years long, but a recent measurement of many more varves gave an

Fig. 2—Paired Beds of Calcareous and Argillaceous Mudstone that Record the 603 Year Climatic Cycle Caused by Planet P

average of about 12.5 to the inch, indicating a climatic cycle of about 675 years. In the articles above mentioned, it was explained that white calcium carbonate is precipitated from sea water during the warm phase of a cycle; and that an annual marine varve often has a white lamina at its center, recording the summer season.

Incidentally my "field surveys" of stratified varved rocks now have covered about half our states and much of Mexico, disclosing remarkably uniform averages of varve thickness in widely different geological horizons. Prof. Udden's 6400 varves in Texas Permian rock, above mentioned, averaged 185 to the foot. Prof. L. D. Stamp in 1925 measured many varves in Burma Eocene that averaged 174 to the foot. Archibald Geike's "seams or ribs" in English Ordovician "highly fissle shale" averaged 20 or 30 to the inch.

Such varves are the Rosetta Stones by which geological history becomes decipherable as to cyclic epochs. Because such cycles have repeated themselves as to lengths, though not as to amplitudes, in different geological horizons, we may be sure that they still exist. Since the last wet peak of the 672 year cycle was in A.D. 1658, its next dry valley will occur 336 years later, in A.D. 1994. For nearly a century this eventual climax of drought has clearly "cast its shadow before" in many regions. For example Nisqually Glacier, near Puget Sound, has been retreating at least since 1857, with accelerated velocity except about 1882 when a cycle of ⅓ of 672 or 224 years had a wet-cold peak. That 224-year cycle has a subcycle of ¼ of its length, which in turn has one of ⅓ its length, and so on. Hence it is evident that not all weather cycles are caused by planets. What does cause them? An attempt to answer this highly important question will be made in the forthcoming booklet.

In 1919 George E. Hale discovered that sunspots usually occur in pairs rotating oppositely and of opposite magnetic polarity. I infer that they exemplify Faraday's principle of magnetic rotation of electric currents, and that the streams of ions emitted from the sun also rotate in accordance with that principle. If so, each ionostream has a core of heavy positive ions surrounded by a large shell of the lightest negative ions, namely electrons, rotating in a direction opposite to that of the core. This gives to both core and shell the same magnetic polarity, and therefore they are attracted by the opposite magnetic pole of the Earth. Hence ionostreams issuing from the sun's southern hemisphere are attracted by our north magnetic pole and other north magnetic foci, while those issuing from the sun's northern hemisphere are attracted by our south magnetic pole. Many hitherto puzzling phenomena are thus made clear.

Since similarly charged ions moving in the same directions attract one another magnetically, it follows that a solar ionostream is a strongly cohering rod. Part of the corherence is due to magnetic, part to electric forces. The sun's radiant waves propel the constantly generated ionostreams radially away from the sun,

but their elasticity permits deflection toward any permanent or any induced magnetic focus. Since all radiant waves have the velocity of light, I infer that they accelerate the ions of an ionosphere until they attain either that velocity or a close approximation to it.

There is evidence that both the Earth and Sun are magnetic cores surrounded by a large number of relatively thin concentric ionospheres. I infer that these shells rotate in the same direction that the Sun and Earth rotate, in accordance with the Faraday principle above mentioned. Every comet, I believe, exemplifies the ionospheric theory, and perhaps the same is true of every star. The small bright nucleus of a comet probably is an ionosphere, and its huge head is another. At times, as in Donati's comet of 1857, a comet has two concentric heads, the outer twice as big as the inner one.

It seems significant that in the eclipse of 1937 a photograph taken from an airplane by Maj. A. W. Stevens disclosed that the pearly corona was a perfect sphere of just twice the diameter of the sun. I infer that the incandescent photosphere and the corona are two of numberless solar ionosphere shells, all rotating axially, all fed with ions from ionostreams and in turn feeding ions back into solar ionostreams, and performing another function of supreme importance. Since an ionospheric shell must refract or bend radiant waves, each solar ionostream is propelled also by refracted waves, so that energy lost by ions penetrating an ionosphere is regained, in large measure if not entirely, in this manner.

There is another refracted effect of a great series of solar ionospheres which, upon consideration, leads to starting inferences. The distances to the nearer stars have been triangulated, using the diameter of the Earth's orbit as a base line. But since no refraction, other than that of our atmosphere, was taken into account, it follows that all estimated stellar distances must be exaggerated if there is a series of solar ionospheres exceeding in diameter that of the Earth's orbit. This thought led me to infer that the "proper motions" of at least the brightest stars might be orbital motions around the Sun. On this assumption I deduced first the orbital periods and then the distances, of the 22 brightest stars, with the expectation that these distances would differ more from the triangulated distances, the greater the distance. In general this is the case. The average exaggeration of these distances by triangulation is about 130 fold.

For stellar distances beyond the range of triangulation, which applies to the vast majority of stars, formulas involving relative brightness are invoked. But since a series of solar ionospheres would obscure stars increasingly with distance, exaggeration of their estimated distances would probably be amazing. Of course estimates of volume and mass of stars and star clusters would be even more exaggerated than those of distance.

There are numerous short cycles whose lengths or pulsation periods are measured in minutes or seconds. These may be classed as microcycles, for the terms microseisms (crustal tremors) and microbaroms (barometric pulsations) have been in use for many years. A less generally known type of microcycle is seen, at times, in regular pulsations of the delicate compass needle of a magnetograph. These might be called micromagnetics. Having observed that several microcycles have the same lengths in crustal and compass pulsations, as well as in lake and ocean waves called seiches, I was led to investigate microcyclic phenomena. This resulted in the recent discovery that there is a triplex law of their relationship as to lengths, like the triplex law of climatic cycle lengths which I announced in 1938; namely that cycle lengths often are terms in a geometrical progression series whose ratio is three.

Microseisms (which I believe are caused by micromagnetics have been used effectively by Marion H. Gilmore and naval associates to discover, locate and follow typhoons and hurricanes.

Therefore not only because of their theoretical but practical importance, microcycles will be discussed in the forthcoming booklet whose title will be "This Cyclic Universe."

Wisconsin Public Service Comm. Will Settle Milwaukee's Surburban Water Service Controversy

For many years the city of Milwaukee has had controversies with its suburbs as to the supply of water to industry and residents outside of the Milwaukee city limits. In many instances the Wisconsin Public Service Commission has ironed out the argument, mostly in favor of the suburb. Now an odd situation has arisen in the case of a new plant for General Motors Corporation, the location being partly in the city of Milwaukee and partly in the town of Milwaukee to the north, lately taken in by the newly incorporated city of Glendale.

Just two foot length of water pipe appears to be the bone of contention, that length being necessary to connect two buildings of the G.M. plant. One third of a new building is located within the Milwaukee city limit, while the other two thirds is over the line and in the new city of Glendale. Glendale has no water system, but a two-foot piece of pipe, if installed between the two G.M. buildings, would give the buildings on the Glendale side Milwaukee city water. It appears that when the General Motors plant was planned in 1950, it was believed that this territory to the north of Milwaukee would be taken in by the city, but the Glendale people thought otherwise.

An engineer for the new City of Glendale declared that the pipe connection could be made in 15 to 30 minutes, and the General Motors officials state that very little water would be used in the buildings outside of the Milwaukee city limits. The principal service to be rendered by the connection is that of fire protection on the Glendale side of the line. Only water for a water fountain and a toilet for workmen would be supplied on a metered basis.

Milwaukee's superintendent of water, Edward F. Tanghe, declared that due to a resolution adopted by the Milwaukee Common Council in 1943, the Milwaukee Water Department is forbidden to extend water service outside of the city except where commitments had already been made. Supt. Tanghe found that in February, 1950, a permit had been granted to the General Motors Corporation for the new plant within the Milwaukee city limits.

Now the controversy has been taken to the Wisconsin Public Service Commission for a decision—J. E. Hubel.

Had His Share of Hell!

A water "Super" stood at the Pearly Gate,
His face was lined and old.
He stood before the Man of Fate,
For admission to the fold.
"What have YOU done," St. Peter said,
"To gain admission here?"
"I've run a small town water works
For many, many, many a year," he replied.
Then, those Pearly Gates swung open wide.
St. Peter rang loud the bell,
"Come in and choose your harp," he said,
"You've already had YOUR share of hell."

Geo. M. Golimbert, Ontario Dept. of Health.

Our City—

Its Scientific and Engineering Problems in Purchasing

by WM. E. KIRKENDALL, *Corrosion Control Specialist, Los Angeles, Calif.*

THE United States of America is recognized throughout the world as the cradle of free enterprise. In our government, we do not submit passively to controls of any superstate. We demand a voice in government. "No taxation without representation" has been our motto ever since the issuance of our country's birth certificate in 1776. We, the people, want to know what our public officials are doing for us, why it should or should not be done, and what it costs us per unit of accomplishment.

Our municipal public service utilities (i.e. water, gas, electricity) depend for sources of supply of structural materials upon reputable manufacturers and vendors of the products and services needed. To avoid political favoritisms and all possible influences by special interests of any kind, a system known as the "letting of contracts to the lowest responsible bidder" has been developed—and this is where the public official's real problems begin.

How, for instance, is the City Manager or the Engineer of Public Works to measure relative degrees of "responsibility" of several competitive bidders on a contract to construct a new pipe line for bringing a larger, better, and more dependable water supply to our city? Financial standing and responsibility of the bidder is not the only measure. That is only one amongst several yardsticks, a very important one, true; but, how about other measures of reputation for integrity and service?

Where is our standard of measurement for comparing the calibrations of our several yardsticks in the public service?

An Actual and Real Problem in California Water Supply

The City of Metropoli (fictitious name of a city in California, not Italy—one that is typical of your city and of mine) has planned the construction of an aqueduct for bringing to its people a bountiful supply of life giving water from the "Red River" (also fictitious but typical name) a hundred miles or more away. The Engineer of Public Works has determined feasibility of the project on a self-supporting and self-liquidating basis. The Reconstruction Finance Corporation (or other Federal Lending Agency) is ready to purchase Fifty Year Amortization Revenue Bonds to provide the necessary financing, and all details have been arranged except letting of the construction contract, under the system of competitive bids. Estimated minimum service life of the aqueduct to be constructed is to be fifty years or longer, and it is planned and expected that the structure will last much longer than a hundred years if properly designed and maintained.

The "ABC" Construction Company has submitted a proposal to build a steel pipe line, to be heavily bituminous enamel coated for X miles of its length where it must pass through areas of variable soil corrosivity along its route. The remaining portion of the aqueduct, which passes through areas of only mildly to slightly corrosive soils, is to be left uncoated and unprotected except for the thin shop-dip coating it may still have as received along the route of the pipe line. It is thus planned to extend the service life of pipe to be located in the severely corrosive soil areas, by means of the heavy enamel protective coating application, so that it should approximate the service life of the uncoated pipe located in the slightly corrosive soils along the route of this new aqueduct.

The "XYZ" Construction Company has submitted an alternate proposal and bid to build the same general type of steel pipe line, but instead of applying a heavy coating of enamel for X miles of its length the "XYZ" Company proposes to apply Y miles of cement gunite coating on the pipe in the moderately corrosive soil areas and Z miles of extra heavy water works enamel coating on the pipe where it must extend through the more severely corrosive areas. In addition, there is to be provided supplemental magnesium anode cathodic protection in the relatively short lengths of exposure to the most severe corrosive environment, together with provision for additional test points and a series of future connection points for cathodic protection installations at some future date, should they become necessary or advisable.

Since it is desired to obtain the longest possible trouble-free service life from this important water supply line, and since the "XYZ" Company's proposal provides for future correction of presently unforeseen adverse conditions when and if such may develop at a later date, their proposal and bid is receiving favorable consideration as being more economical in annual charges for amortization and depreciation when extended over the entire expected life of the new aqueduct than the "ABC" Company's proposal and bid, although the initial first cost under the "ABC" Company's bid would be somewhat less. The Engineer of Public Works has brought these facts and engineering estimates to the attention of the City Manager, pointing out that the phrase "lowest responsible bidder" as provided in the City Charter and basic law does not necessarily mean the cheapest thing available regardless of service life expectancy and relative freedom from excessive maintenance costs.

Supplemental Considerations of Flexibility and Maintenance

Included in the "XYZ" Construction Company's proposals and bid are two sub-contract bids by the "Q" Magnesium Anode Company and the "K" Magnesium Anode Company for supplying the anodes required to provide the cathodic protection. The "Q" Company asserts

This is a true story, with names of persons and places changed (all except the author's) for obvious reasons. It has been prepared to convey a realistic understanding of basic engineering and science problems of the water works and underground pipe line industry, problems needing immediate attention of any research and engineering organization capable and willing to contribute constructive information and data. It has been offered for publication with the thought of focussing attention of competent authorities upon the importance of its subject matter, and solicitation of aid in finding practical solutions to the problems presented.—W.E.K.

*Member, Nat'l. Ass'n. Corrosion Engineers.

that its anodes are so alloyed and cast as to assure a uniform microstructure of the anodic magnesium, free from dissimilar metals crystalline particles and therefore less susceptible to micro-cell self-corrosion than competitor's products. They claim that production of their uniform-microstructure anodes is more costly than other processes of manufacture and that the higher production cost (but longer service life) fully justifies their higher price. For this slightly higher price, they assert that their anodes will far outlast and outperform competitor's products.

The "K" Magnesium Anode Company, on the other hand, insists that its product is identical in quality and in chemical composition with their competitor's products; and they have submitted certified quantitative chemical analyses of their anodes as proof of their contentions. If their contentions are true, the public official has no choice but to accept the "lowest responsible bid," as provided by law.

The Engineer of Public Works can neither prove nor disprove the contentions of the respective subcontract bidders, other than verification of the over-all quantitative chemical analyses submitted by each of them. By independent determination and verification he has found that the "Q" anodes and the "K" anodes have almost identical over-all quantitative chemical composition. But he has observed that, to the naked eye, there appears to be a slight difference between the products which the chemical analyses do not account for or suggest any explanation of. Because many millions of dollars of the people's investment in this aqueduct may depend upon the accuracy and correctness of his decisions at this time, the Engineer of Public Works is determined to learn the truth about magnesium anodes offered for use in cathodic protection of steel pipe lines against corrosion.

The Quest for Expert Counsel

The Chief Metallurgist for a local manufacturer of military aircraft has suggested that there may be some truth in the contentions of the "Q" Magnesium Anode Co. as to the relative merits of their uniform-microstructure magnesium alloy castings for use as anodes. He has shown the Engineer of Public Works for the City of Metropoli the differences in metallic crystal structure of magnesium alloys having identical over-all quantitative chemical composition but entirely different microstructure of the matrix resulting from various heat treatments and differential cooling rates from the molten state. He has explained the effects of precipitation of dissimilar micro-constituents from solid solution and deposited heterogeneously at the grain boundaries between metallic crystals of more uniform composition. He has explained how, by methods of X-ray diffraction and by methods of chemical microscopy, these dissimilar particles and metallic alloy crystals may be analyzed and identified.

The Engineer of Public Works has requested the "Q" Magnesium Anode Co. and the "K" Magnesium Anode Co., as well as all others who may wish to submit bids for supplying the "City of Metropoli" with magnesium anodes, to furnish photomicrographs of typical and representative samples of their products, as well as the over-all quantitative analyses, to be used as a basis of comparison and measurement of relative excellency of competitive products. Micrographic standards of comparison are now being assembled and will be used as "yardsticks" of measurement of compliance with specifications. They will be a determining factor in acceptance of bids to supply the city with magnesium anodes for cathodic protection use. Any bids submitted without inclusion of the required photomicrographs will be rejected for reason of insufficient evidence of compliance with specifications.

The Engineer of Public Works has requested the writer of this article to present his problem to the Departments of Metallurgy of internationally recognized universities and schools of science and engineering; to the National Bureau of Standards; to the several American Engineering Societies, including the National Association of Corrosion Engineers; to the Batelle Memorial Institute; and to the British Non-Ferrous Metals Research Association in his quest for reliable standards of comparison and classification of photomicrographs of metallic crystal structures of magnesium alloys suitable for use as anodes in cathodic protection of pipe lines and other engineering structures against corrosion. The data and standards to be collected and classified are to be used in preparation of specifications for magnesium anodes to be purchased, and as measures of relative excellence of products offered to the city under the system of competitive bids by manufacturers and vendors of the materials, items, and services needed.

Ed. Note: We will be pleased to transmit to author Kirkendall and his "City of Metropoli" any material or inquiries addressed to either in care of this magazine.

Ohio Village Sets Example in Sewage System Financing

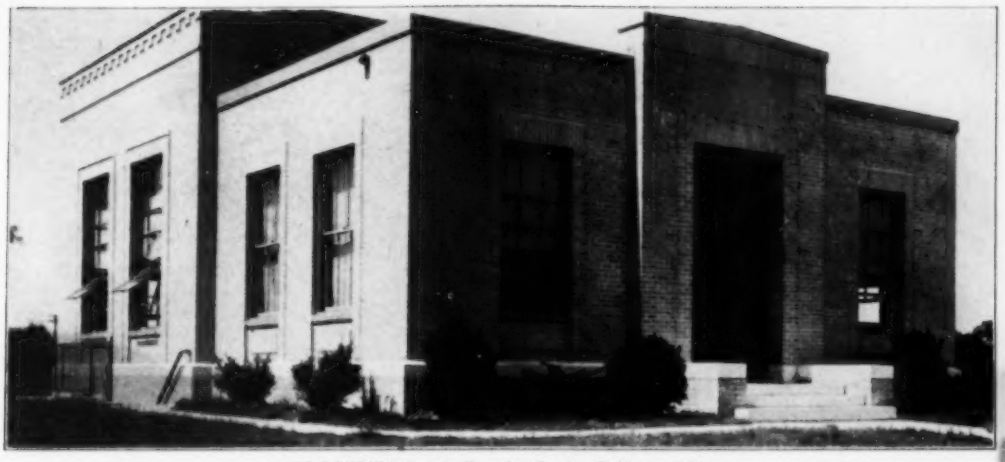
Under the title "Hats Off!" the Cincinnati *Enquirer* paid editorial tribute to the village of Loveland. (According to the 1940 census, the population of Loveland was 1,904.) The editorial reads:

"To the village of Loveland falls the honor of being the first of many villages in Hamilton County to start on a sewage disposal system under the anti-pollution program now under way. Following sound practice, Loveland will finance its system through revenue bonds, supplemented by special assessment notes. Contracts already have been let, and construction probably will start March 1.

"This action sets a wholesome example for other villages of Hamilton County and for the many small cities through the state which have yet to deal with their stream pollution problems. And Loveland should also have the satisfaction of completing its disposal system well in advance of Cincinnati. For while Cincinnati commenced a long time ago, it has a very much larger task and will need a much longer time to finish it.

"We now have proper legislation in Ohio to insure ultimate completion of the entire job of stream purification. But legislation is not the main thing. What is even more important is the willingness of village and city councils and voters all through the state of Ohio to shoulder their share of the responsibility, raise the local revenue required, and solve their own pollution problems.

"Loveland is the latest of many Ohio communities to take affirmative action. But some scores of communities still must act before we can say the problem of polluted streams is really in hand."



BROOKLYN Sewage Pumping Station, Baltimore, Md.

Baltimore's New Sewage Lift Station

Latest Addition to Its Sewage Pumping Facilities

by C. E. KEEFER, *Deputy Sewerage Engineer, Baltimore, Md.*
(Editorial Associate, W. & S.W.)

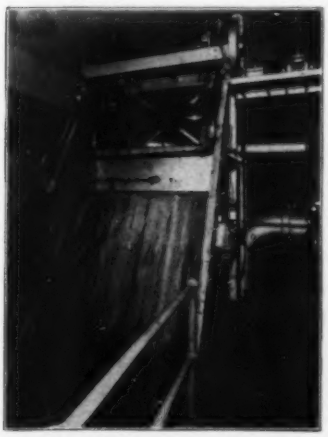
PRIOR to 1951 the City of Baltimore was provided with three sewage pumping stations. The largest of these, put in service in 1911, is the Eastern Avenue pumping station[1, 2]. It is situated in the central part of the city adjacent to the harbor. It handles a large part of the sewage from the industrial and business section of the city and discharges it into the main outfall, which terminates at the Back River sewage-treatment works. The flow from this station during 1950 averaged 39.61 m.g.d.

The second sewage pumping station to be built was put in service in 1940. It is situated in the southern part of the city at the Patapsco sewage-treatment works. The present maximum capacity of this station is 19.8 m.g.d. The third station, known as the Dundalk sewage pumping station[3], was put in operation in 1947. It is situated in southeast Baltimore and has a maximum capacity of 11.3 m.g.d.

These three stations have been supplemented by the Brooklyn pumping station, which was put in service in 1950. With the completion of this station an appreciable volume of sewage, which formerly entered the Patapsco River, has been diverted to the Patapsco sewage-treatment works.

The Brooklyn Sewage Pumping Station, built at a cost of $394,523, is situated on the south side of the Patapsco River, approximately one-half mile north of the southern boundary of the city. It will serve not only a considerable area in Baltimore City south of the Patapsco River but also the northern portion of Anne Arundel County, which lies south of Baltimore, and a portion of Baltimore County west and south of the city.

The station is a one-story building, Approximately 36 x 44 ft. in plan, built of light gray brick with dark brown terra-cotta trim. The main



AUTOMATICALLY operated sewage screen. Screenings are disposed of by grinding and discharging into sewage.

INLET channel to pumping station. Motor-operated sluice gate for incoming sewage —Venturi meter in discharge line.

BROOKLYN STATION COST AND OPERATING DATA

COST: Building	$220,805	PUMPS: Present units	(2) 3,000 g.p.m. (1) 7,000 g.p.m.
Mechanical and Electrical	173,718	Future units	(3) 7,000 g.p.m.
Outside Piping	65,107	HEAD: Static	25.9 ft.
Total	$459,630	Friction	15.1 ft.
AREA to be served, ultimate	4.7 sq. mi.	Total	41.0 ft.
POPULATION to be served, ultimate	77,080	FORCE MAIN: Diameter	24 in.
PUMPING CAPACITY (with one pump out of service):		Length	1,586 ft.
Present equipment	8.48 m.g.d.	SCREEN: Mechanically cleaned	(1) 6 ft. wide
Future equipment	19.80 m.g.d.	STAND-BY GENERATOR: Gasoline-engine-driven	(1) 250 KVA
		BUILDING HEAT: Gas-fired steam boiler	

floor of the building contains a gallery immediately above the pump room, an office, a toilet room, a switchboard enclosure and a stair well to the lower floor. The interior walls of the superstructure are lined with buff-shade 5- x 12-in. tile.

The substructure, which is built of heavy reinforced concrete, contains a pump room, a screen room and suction well adjacent thereto and other smaller rooms for additional auxiliary equipment. All the walls in the substructure except those in the screen room and suction well are painted with buff-color cement paint. Suspended above the pump room on rails that extend the full length of the room is a 10-ton hand-operated traveling crane.

Screening Facilities

Sewage enters the station through a 36-in. cast-iron pipe, the invert of which is 10 ft. below mean low tide and approximately 17.5 ft. below the ground. At the point where the above-mentioned sewer connects with the pumping station a motor-operated 36-in. sluice gate, that can be operated either manually or automatically, has been provided. When this gate is closed, sewage is diverted from the suction well of the station through an overflow pipe into the harbor. After passing through the sluice gate the sewage flows through an automatically operated screen, which is set at an angle of 60° with the horizontal. This screen, which has a maximum capacity of 22 m.g.d with a loss of head of 6 in., is 6 ft. wide and is submerged to a depth of 5 ft. when the sewage is at its maximum elevation in the suction well. The screen is made of 3- x ⅜-in. tapered wrought-iron bars having clear openings of ¾ in.

The screenings are raked up a dead plate and deposited on a 12-in. rubber belt, which discharges into a

GALLERY over pump room—electrical control board in rear corner.

BROOKLYN STATION BUILDERS AND SUPPLIERS

BUILDING and OUTSIDE PIPING	Chesapeake Contractors, Inc. Baltimore, Md.	AIR COMPRESSORS	Ingersoll-Rand Co.
MECHANICAL and ELECTRICAL EQUIPMENT	Dravo Corporation Philadelphia, Pa.	CONE VALVES	S. Morgan Smith Co.
		FLOAT CONTROL	Automatic Control Co.
		VACUUM PUMPS	Nash Engineering Co.
SEWAGE PUMPS	De Laval Steam Turbine Co.	VENTURI-METER EQUIPMENT	Builders-Providence, Inc.
MOTORS, GENERATORS, and CONTROLS	Westinghouse Elec. Corp.	CAST IRON PIPE	U. S. Cast Iron Pipe & Foundry Co.
		GATE VALES	Crane Co. & Rensselaer Valve Co.
GASOLINE STAND-BY GENERATOR	Climax Engine Co.	SLUICE GATE	Filer & Stowell
SEWAGE SCREEN	Link-Belt Co.	SUMP PUMP	Yoemans Brothers Co.
SCREENINGS GRINDER	Gruendler Crusher & Pulverizer Co.	VENTILATORS	Production Planning Co.

screenings grinder, operating at a speed of 2,100 r.p.m. Water for flushing purposes is admitted to the belt conveyor and the grinder by a solenoid-operated valve.

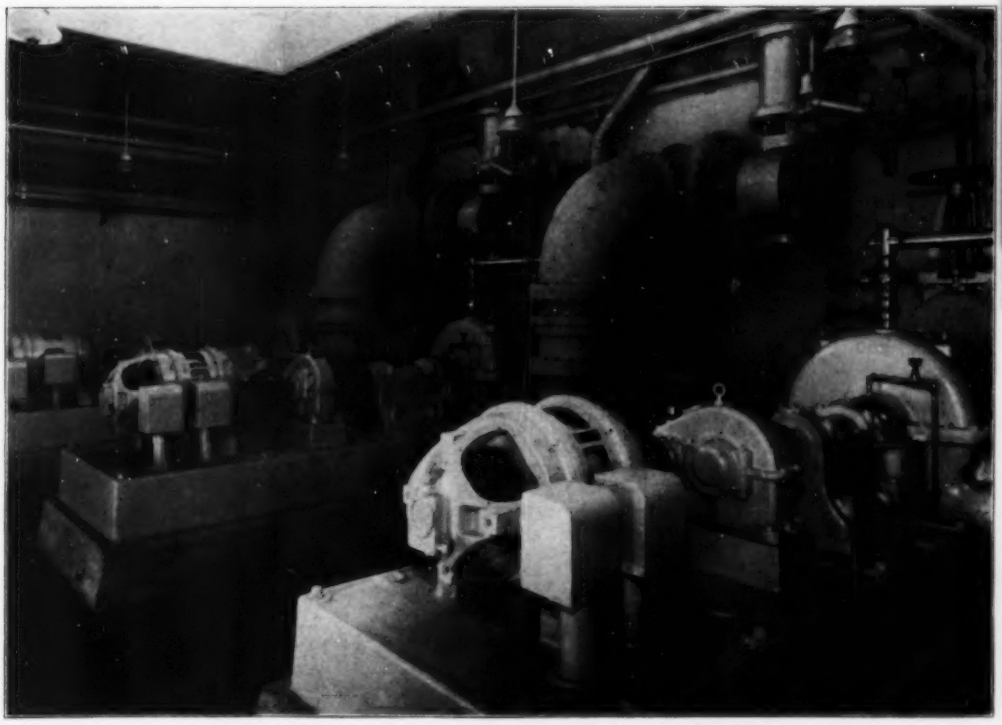
Immediately on the up-stream side of the screen there are weirs in both walls of the channel leading to the screen. The top of the weirs, which are 11 ft. long, is 6 in. above the maximum level of the sewage in the channel. If the screen should become clogged, causing the sewage to back up, sewage can flow over the weirs into two by-pass channels around the screen. Stop-plank grooves are provided on the up-stream side of the screen so that sewage can be diverted around the screen if necessary.

After passing through the screen the sewage flows to the suction well. There is no direct communication between this well and the rest of the station. Thus, it is impossible for the remainder of the station to become flooded with sewage. Access to the screen chamber and suction well is by an exterior stairway.

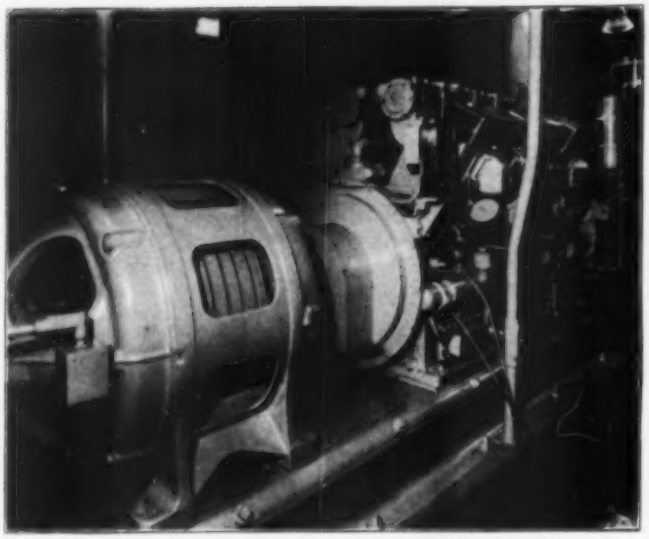
The screen room and the suction well are ventilated by a fan having a capacity of 5,600 cu. ft. per min. This fan, which produces an air change every 2 minutes, introduces fresh air into the down-stream end of the suction well and forces it either up the incoming sewer leading to the station or through a vertical ventilator in the roof of the screen chamber to the outdoors.

Pumps and Appurtenances

Adjacent to the suction well is the pump room, which is approximately 36 x 22 ft. in plan. This room contains 3 motor-driven horizontal centrifugal pumps. Two of these have a capacity of 3,000 gal. per min. each, and the third has a capacity of 7,000 gal. per min. At a later date when the flow increases, the two



PUMP ROOM equipped with automatically-operated DeLaval sewage pumps.



STANDBY Climax gasoline-engine-driven 250 KVA generator.

3,000-gal. per min. pumps can be replaced by 7,000-gal. per min. units.

The characteristics of the existing pumps are as follows:

Capacity g.p.m.	Size drive motor hp.	Speed r.p.m.	Overall efficiency of pump and motor	Diameter of sphere pump will pass in.
3,000	40	432	74.8%	5
7,000	100	495	89.2%*	5

*Efficiency of pump only.

Slow speed pumps have been installed to insure long pump life. They have large passageways to reduce their tendency to clog. The pumps have non-clog impellers with flat bronze wearing rings. In order to increase the wearing characteristics of the pumps, the casings and the impellers are made of cast iron containing .2 per cent nickel and 0.2 per cent chromium.

The suction pipes to the pumps pass through the dividing wall between the suction well and the pump room and project vertically downward into the sewage. In the discharge pipe from each pump there is a 20-in. oil-operated cone valve. These valves are provided with automatic controls for synchronizing the operation of the valves with the starting and stopping of the motors driving the pumps.

The discharge pipes from the sewage pumps connect with a 24-in. cast-iron manifold, which is suspended from the ceiling of the suction well. In this manifold there is a 24- x 14-in. Venturi-meter tube for measuring the sewage flow. Pressure piping extends from this meter to an indicator-register-recorder set in a panel of the main switchboard.

The discharge piping from the station is designed so that the sewage can be pumped either through a 24-in. cast-iron force main, which is 1,586 ft. long, into a trunk sewer and thence to the sewage-treatment works or into a storm drain, which discharges into the harbor. The latter outlet will be used only in case of a failure of the force main. In the discharge pipe, a Y branch has been provided so that an additional 30-in. force main can be connected to it when the sewage flow increases.

Standby Power Unit

There are three rooms adjacent to the pump room. One of these contains an automatically operated, gasoline-engine-driven, 250-KVA, 440-volt generator. In case of a failure of electric power, which is supplied by the local power company, the gasoline engine will start automatically and produce all the power used in the station. The engine is protected against a failure of cooling water, excessive cooling water temperature, low oil pressure, against the engine starting with an advanced spark and against repeated and unsuccessful starting. Under normal conditions the gasoline engine could not be operated if there should be a failure of the water supply serving the staiton. To avoid this difficulty, the station is provided with a 22,000-gal. water reservoir located in the basement of the building adjacent to the suction well with pipe connections to the engine. A pump on the engine draws water from this reservoir, forces it through the engine jacket and discharges it again into the reservoir. If the supply of cooling water to the station should be cut off, it is estimated that the gasoline engine could be operated for at least a day before the cooling water would become so hot that the engine would have to be shut down. Fuel for the gasoline engine is stored in a 1000-gal. steel tank, which is buried in the ground and encased in concrete.

Automatic Pump Priming.

As the pump room floor is 2.5 ft. higher than the maximum elevation of the sewage in the suction well, the sewage pumps are kept primed by means of two centrifugal displacement-type vacuum priming pumps, one of which is a stand-by. Each pump has a capacity of 62 cu. ft. of air a minute. A vertical vacuum pipe, 6-in. in diameter, connects with the top of the suction pipe leading to each sewage pump. Six-inch pipes were used to minimize the possibility of their becoming clogged. The vertical pipes connect with a vacuum tank containing 32 cu. ft. and then with the two vacuum pumps. Four mercoid vacuum switches are provided in the vacuum pipe line. One of these operates one of the vacuum pumps, the second operates the other vacuum pump; the third sounds an alarm if the vacuum should be lower than a predetermined amount; and the fourth shuts down the sewage pumps if the vacuum drops still lower, to prevent their operating with no sewage in them.

Oil Operated Valves.

On the lower floor of the station there is an oil accumulator system for operating the cone valves. This system consists of a two-compartment steel tank for the storage of oil, two Imo oil pumps and two air compressors. Oil is maintained under pressure in the upper compartment of the storage tank to operate the hydraulic cylinders on the cone valves. The lower compartment, which is at atmospheric pressure, serves as a reservoir for the oil as it discharges from the above-mentioned hydraulic cylinders. Each oil pump has a capacity of 5 gal. per min., and each air compressor a capacity of 3 cu. ft. of free air per min. The oil pumps deliver oil from the lower to the upper compartment of the tank, and the air compressors maintain the oil in the upper compartment under pressure. The oil

pumps are actuated by means of float switches. One of the float switches starts one of the oil pumps if the oil in the pressure compartment falls to a predetermined lever. If the oil level continues to fall, the second float switch starts the other pump. In like manner, two pressure switches control the operation of the air compressors. The float switches and the pressure switches are connected electrically so that the air compressors will not start unless the oil level is normal. The oil storage tank is sufficiently large to permit two operations of each of the three cone valves without it being necessary for either the oil pumps or the air compressors to operate.

Other Auxiliary Equipment.

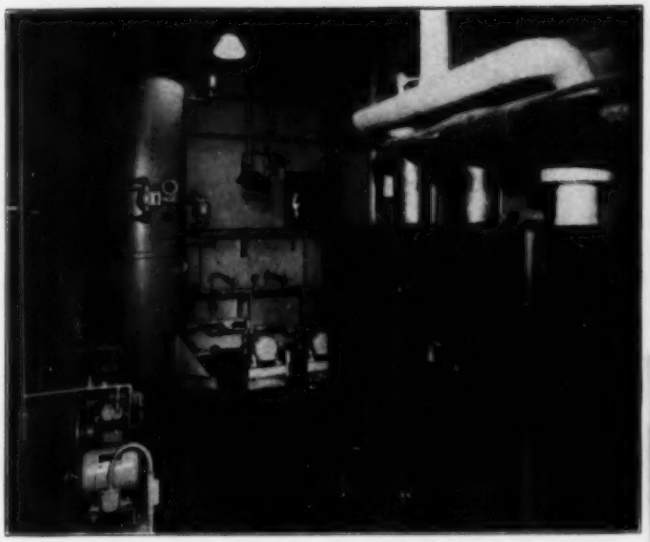
Other auxiliary equipment in the station includes a displacement-type water pump, which has a capacity of 240 gal. of water per hour when operating against a pressure of 50 lb. per sq. in. This pump furnishes water to the glands of the sewage pumps and to the small piping that connects with the piezometer rings on the Venturi-meter tube. Using this pump prevents the possibility of a cross-connection with the municipal water supply.

Although there are no cross-connections in the pumping station, there is no assurance that they will never be made by irresponsible workmen. To protect the city water supply in such an eventuality a double check-valve assembly with the necessary gate valves, pressure gages, test drains and vacuum relief valve was installed in the water supply pipe serving the station in accordance with the standards of the National Fire Protection Association'.

A vertical sump pump having a capacity of 20 gal. per min. is provided in a pit in the basement of the building for general drainage purposes.

Sewage, cold water and other pipes on which it was anticipated condensation would accumulate were coated with a plastic insulating compound ½-in. thick.

As the station is situated only a few hundred feet from the Patapsco River, the entire foundation was waterproofed with a 5-ply, coal-tar-pitch saturated woven cotton fabric. This waterproofing extends under the foundation and up the sides of the substructure. The waterproofing under the bottom of the substructure is protected by a mat of reinforced concrete 6 in. thick, and around the sides by brick masonry 4½-in. thick.



OIL ACCUMULATOR equipment for operating cone valves. Two-compartment oil-pressure tank and pumps in rear, air compressors in foreground.

Electrical Equipment

The pumping station is served by a 440-volt underground power line, which terminates at a circuit breaker in the building. Power is then fed to a dead-front control board containing six panels. This board is mounted in the wall of the gallery room and is accessible from both the front and the rear. The electrical equipment on the board controls all motors in the station. One of the panels contains an indicator-recorder-register, which is used in conjunction with the Venturi-meter tube, a gauge that indicates the vacuum in the priming system and another gauge that indicates the level of the sewage in the suction well.

The mechanically cleaned sewage screen can be operated manually or automatically by an electric timing device. This device is adjustable so that the screening equipment can operate continuously or for periods from 1 to 30 minutes at regular intervals.

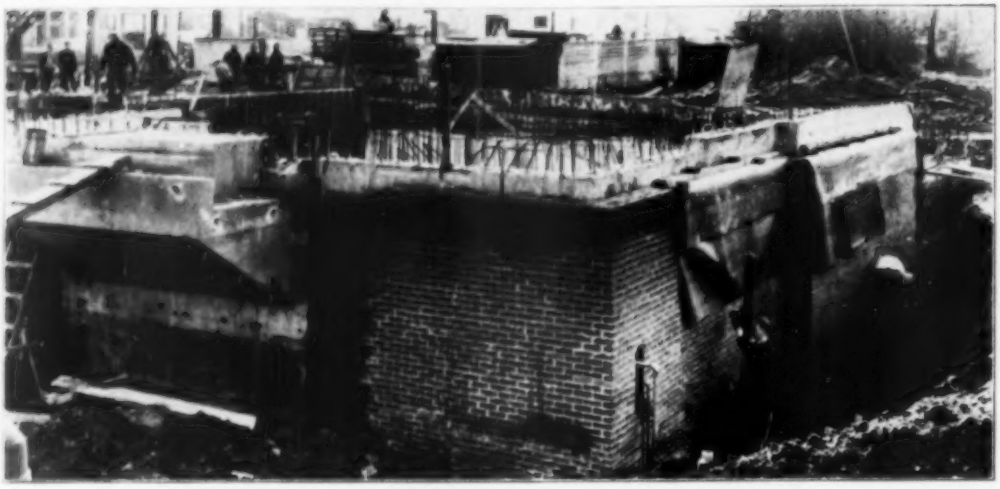
In the suction well there are three float-operated, pedestal-mounted, explosion-proof control units. They contain snap-action mercury switches, that operate the three sewage pumps and the motor-operated influent sluice gate, and that sound an alarm if the sewage level in the suction well is excessively high or low. Each control is equipped with a ceramic float suspended from a stainless steel tape in a vertical float tube. Flushing water, controlled by brass needle valves, is introduced into the top of each float tube to prevent the formation of scum and grease in the tubes.

The electric motors, lights and other electrical equipment in the screen room and suction well are explosion proof. This provision was considered essential to avoid an explosion in case inflammable liquids or gases should enter the suction well.

Safety Provisions and Measures

Each sewage pump starts when the sewage reaches a predetermined level in the suction well. When any pump attains full running speed, a pilot valve solenoid is energized to open the cone valve in the discharge pipe from the pump. If the cone valve fails to open, the pump-motor will shut down automatically. In the event the sewage is pumped down to an excessively low level in the suction well, the float-control unit closes any open cone valves and shuts down any pumps in operation. The controls on each cone valve are designed so that any sewage pump motor will be deenergized if the cone valve fails to close after a pre-determined period of time. The sewage pump motors are interlocked with the vacuum priming system so the motors will shut down if the vacuum should drop to a predetermined low pressure and will remain inoperative until the vacuum is adequately increased.

Except when periodic inspections are made, the pumping station is un-



STATION construction details—foundation waterproofed with coal-tar-pitch saturated fabric.

attended. When no one is at the station, it is essential to know immediately if trouble should occur. A pair of wires extending underground from the station to an alarm in the Eastern Avenue sewage-pumping station, where one or more operators always are in attendance, is rented from the local telephone company. This circuit, which is normally closed, serves to sound an alarm if any of the following abnormal conditions occur:

1. High or low sewage level in the suction well.
2. High water level in the well containing the sump pump.
3. Low vacuum, that keeps the sewage pumps primed.
4. Low city water pressure in the station.
5. Low water pressure in the pipes that connect with the glands of the sewage pumps.
6. Low oil pressure that operates the cone valves.

The work of building the station was let under two contracts—one for the building and the sewer pipes in the adjacent street and the other for the mechanical and electrical equipment in the building. The cost of the work done under the former contract amounted to $285,912 and under the latter $173,718. Work was begun on June 10, 1949 and completed on October 2, 1950.

In general the construction of the pumping station presented no unusual difficulties. The sides of the excavation, which in places was 26 ft. deep, were supported by steel sheet piling, and the site was kept dry by means of well points and centrifugal pumps.

The Brooklyn sewage-pumping station is under the general supervision of P. L. Holland, director of public works and John J. Hunt, sewerage engineer, with Robert J. Trautman, principal associate engineer. Dr. Abel Wolman is consultant to the Department of Public Works. Frank O. Heyder, deputy building construction engineer, served as architect, and Malcolm L. Fallin, superintendent of construction, was in charge of the construction work. The operation and the maintenance of the station is under the supervision of Henry Becker, superintendent of pumping stations.

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2. Keefer, C. E., "Additions to the Mechanical Equipment at Baltimore Sewage-Pumping Station," *Eng. News-Rec.*, 103, 333 (Aug. 29, 1929).
3. Keefer, C. E., "Pumping Sewage Automatically," *Eng. News-Rec.*, 141, 88 (Sept. 2, 1948).
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Pilot Plant Production of Sewage Sludge Vitamin

"Bountiful" supplies of the growth vitamin B_{12} may be obtained from dried sewage sludge, according to an announcement from Bernard Wolnak, biochemist, of the Miner Laboratories, Chicago, Ill. The firm has been employed by the Milwaukee sewerage commission, since 1945, and a new extraction technique is now in pilot plant stage.

At present, the process is capable of extracting up to 50 milligrams of the vitamin from each pound of Milorganite, the dried activated sludge fertilizer produced by Milwaukee. Test operations on two tons of the sludge indicate it will be possible to extract the vitamin as an extra profit without reducing the value or volume of sludge as fertilizer.

Vitamin B_{12}, of value principally to overcome growth lag and combat anemia, now is obtained chiefly as a by-product of fermentation processes employed in producing antibiotics. The form of vitamin B_{12} suitable for humans costs about $159,000 per pound, while a less concentrated form used for animal feeding is $27,000 per pound; both forms are in short supply.

The Milwaukee Sewerage Commission has applied for a patent on the extraction process, and is considering the construction of a full scale plant for processing Milorganite concentrate into B_{12} vitamin. The commission also holds patents on a method for increasing the yield and speeding up the fermentation of alcohol by adding Milorganite to molasses and converted grain mashes; the factor responsible is unknown, but may be a new vitamin substance.

"Some Capacity"

A nice new shiny water tank on a certain college campus bears the following wording—

"This water-tower was erected in loving memory of our late president.—Henry Wadsworth Morgenthauer."

CAPACITY 150,000 GALS.

Waste Treatment

An Important Element In Industrial Plant Location

by TRUMAN H. SAFFORD, *Chas. T. Main Engineers, Charlotte, N.C.*

THE mounting pollution loads on streams have become a matter of increasing seriousness, and a problem which must be recognized if healthy industrial growth is to result. Therefore, it seems to the writer that it is imperative that the problem of the disposal of industrial wastes, as related to stream pollution, be considered from here on as one of the most important factors in determining the location of new plants. But, in spite of the seriousness of the problem, too often the solution of the waste disposal problem is not given the attention which it deserves in locating those new industries in which liquid wastes are produced.

Economic Aspects and the Know-How Factor

There is an economic aspect to the waste disposal problem which must always be considered. Unfortunately, there is a fairly general opinion by large sections of the public that if this problem is intelligently approached, proper use of research is applied, and management is willing to make the necessary capital expenditures, valuable materials now wasted through the stream can be reclaimed and industrial waste disposal can be put on a paying basis. Unquestionably there are many cases where this was the case, such as the black liquor recovery process in sulphate mills, "savealls" in paper mills and the centrifugal recovery of wool grease. Industry has been diligent in working out such solutions, in the main, and has installed such recovery plants wherever they can be expected to prove economically feasible. Unfortunately, in most cases, both the capital expenditure required for a waste treatment plant and the annual operating costs represent a definite loss to industry.

In the great majority of cases, the best that can be done is to find a solution which will keep the loss due to the waste treatment plant or recovery operations at a minimum, and at the same time protect the public interest; and, to do this requires a high degree of engineering skill and judgment. In this connection it should be pointed out that one has only to read this magazine to learn that some industries consider a satisfactory solution of industrial waste problem a worth-while investment in good public relations. This point of view should be encouraged.

One has only to visit certain portions of the Northeast and Middlewest to realize that the problem of properly disposing of wastes, including both domestic sewage and those from industry, is a difficult one which in some cases has not been properly handled, although the reasons, as we shall see, are understandable. I am told that this situation is even worse in the older industrial regions of Europe. In general, the techniques for treating and disposing of domestic sewages, unless complicated by industrial wastes, are well understood, and to a major degree methods are standardized.

But, in the case of industrial wastes produced by wet processes, methods of treatment are anything but standardized. In fact, research or experimentation on the particular problem is usually the prerequisite to a successful solution, and added to this is again the ability of the receiving stream to provide adequate dilution. This factor makes more difficult the advance planning which must be done when the site survey is being made. Another great difficulty is that the administrative authorities are not yet in a position to set up hard and fast rules again because of lack of experience in a field of so many ramifications, so that judgment in most cases must be based on an advance interpretation of comparatively new technical and administrative procedures.

Many of us can recall numerous examples when the necessity for the eventual treatment of liquid industrial wastes was not recognized, with the result that continued industrial expansion at a particular site has been curtailed. In the Northeast, the region I know best, I can recall only a few instances in which plants were abandoned solely because of difficulties in treating industrial wastes but there are numerous examples when the difficulty in finding an adequate solution of this problem, in addition to other unfavorable factors, prevented further expansion or tipped the scales in favor of liquidation or removal. One cannot stress too strongly that if a region is to have orderly, well planned growth, the problem of the proper disposal of industrial wastes *must* be considered when plants are initially located.

Most of what will be said has to do with the two waste producing industries which are among the leading industries in the Southeastern Section: textile, and pulp and paper mills —although the principles have application in any industry with a liquid waste disposal problem such as the chemical, food processing, and certain of the metal working industries, all of which are becoming increasingly important in this area.

Historical

The question of stream pollution has become acute in the heavily industrialized area of the Northeast. Accordingly, a brief outline of the historical development of industry in that area is of distinct value in discussing this problem as it relates to other regions, so that the mistakes made in the past need not be repeated.

The successful application of power to weaving and spinning machinery resulted in the establishment of the first American cotton textile mill, the famous Slater Mill at Pawtucket, Rhode Island in 1790, and this mill marked the founding of modern industrial United States. Since the power of falling water was the only practical source of power at that time, all mills built prior to 1845 had to be located at water power sites. That the same stream also supplied water for process and afforded a convenient and inexpensive method of disposing of industrial wastes by discharge into the then abundant stream, which supplied the water power, was not then recognized as a consideration of any moment.

*A paper written for publication in Water & Sewage Works and presented before the N. C. Sewage & Industrial Wastes Assn. at Winston-Salem, N. C., Nov. 14, 1951.

The second quarter of the 19th Century was one of great industrial expansion, and many industrial cities and towns built around industries were located on rivers and streams where water powers could be developed.

By 1845 sufficient improvements had been made to the steam engine to enable it to be used as a practical source of power for industry. As a result, plants no longer had to be located at water power sites and we read of the founding of steam driven mills such as the Utica Steam Cotton Mills, the Naumkeag Steam Cotton Mills, etc. But the need of water for boilers as well as process water still made it necessary to locate industries on streams. However, since these uses were not large compared to the amount of water needed for the power to drive a mill, industries could and were established on small streams where the low water flow might be insufficient to assimilate the pollution load and maintain the stream in a sufficiently clean condition.

During the latter half of the 19th Century, both the number of industries increased and individual units grew in size. The source of power had to be either water wheels or steam engines, in which the power was transmitted mechanically by means of gears, belts, and shafting to the pulley of the production machine. This resulted in compact mill layouts with multistory buildings crowded together to keep the amount of belting and shafting at a minimum.

In that "horse and buggy" era most of the help had to live within walking or bicycling distance of the plant, frequently in mill owned villages built in the immediate vicinity. All this resulted in crowded cities and towns strung like beads on a string along the industrial rivers and creeks. This laid the foundation for pollution problems which grew increasingly serious with the years.

The beginning of the 20th Century marked the successful application of the generation and transmission of electric power, and as a result plants could and were built at locations remote from the source of energy. This was one of the important factors which influenced the movement of the textile industry into the Carolinas, which started about 1910 and reached its peak in the period after World War I. Anderson, S. C. became known as the "Electric City," and the mills there were largely driven by power from hydro electric sources in the vicinity.

The earlier Southern cotton textile mills were large grey goods mills and the dyeing and finishing operations were still largely done in the Northeast. At the time of World War I, improvements in water treatment techniques, made it economically feasible to obtain process water supplies suitable for textile dyeing and finishing from the turbid Southern streams. As a result, an increasing number of plants of this type were and still are being established in the area where the grey goods mills are located with the resultant production of large volumes of wash waters from the bleaching, dyeing, and finishing. These wastes, because of their nature and volume, are difficult to deal with. Also, wastes produced in the finishing of goods woven from synthetic fibers offer similar problems.

Until recently the great concentration of woolen and worsted mills has been in the Northeast. The wastes produced by this industry, particularly those resulting from the scouring of wool to remove the grease, and from the dyeing and finishing of cloth are objectionable, difficult to treat, and a major factor in causing heavy pollution loads on some of the streams in New England. Since World War II there has been an increasing quantity of woolen and worsted mills goods manufactured in this Southeastern region, some in existing plants, some in new plants built for the purpose, with the consequent discharge of dyeing and finishing wastes.

Along with the growth of the textile industry, there has been a remarkable growth in the pulp and paper industry which started with the research of Dr. Herty, which culminated in the successful manufacture of pulp and paper from Southern Field Pine. Originally confined to unbleached Kraft pulp, Southern woods are now converted into bleached pulp for newsprint and book paper, as well as a variety of other uses. The wastes discharged from a pulp mill are large in amount, contain considerable pollution, and constitute one of the most difficult to handle in the industrial field. A study of the disposal of wastes from the Kraft Mills in the deep South indicates the magnitude of this problem. In addition there is the related problem of air pollution which must be considered, though it is not germane to this discussion.

Existing Laws and Regulations

Many who read this discussion will be better qualified to discuss the legal background of the stream pollution problem than the writer, but I do feel that some general mention of the legal background is needed as a basis for subsequent discussion.

As I understand it, the basic underlying English common law provides that each riparian owner may use the stream as it flows by his property if he returns the water to the stream substantially unimpaired as to quality and quantity. (In this discussion we need not concern ourselves with the Spanish laws which obtain in the Southwest, which permit appropriation and consumption of water on the premises for such uses as irrigation).

In general, on most streams, the various industries and municipalities have learned to live with each other, taking into account the assimilating ability of streams, i.e., providing a certain amount of self purification with the available dilution. Therefore, while at a given site, water may not have been returned to the stream substantially "unimpaired in quality" by the time it reached the next mill below the quality has been restored sufficiently to permit it to be used, with treatment, for industrial processes or for domestic water supply. There are many, many cases where conditions are worse than this and, as a result of complaints by a lower riparian community or owner, waste treatment plants have been installed to enable the lower riparian owner to receive acceptable water.

Along with these, in many quarters a demand exists that the pollution loads on streams must be lightened. An important factor has been the agitation by those connected with the recreation industry.

Because of the shorter workweek which has given more time for recreation, and ease of travel due to "all-weather" roads and the modern auto we, as a people, have become recreation minded, and the use of the streams and lakes for boating, fishing and swimming is an important phase of recreation. All interested in recreation are most articulate in their demands that pollution be removed from streams and make themselves known through the conservation agencies, The Isaac Walton Leagues, and local recreational associations. In addition, particularly along the coast, established commercial fishing facilities must be taken care of, as well as recreational fishing areas.

As a result of all these factors, i. e., the growth of our cities, more and larger industrial plants, the demands of the recreation interests, legislation has been passed in most states aimed at halting further pollution and looking to working out a gradual improvement of our streams. Recently, the U. S. Public Health Service, charged with administration of the Federal Water Pollution Control Act, has entered the picture on inter-state streams.

In most states there are laws as pending legislation which provide for classification of streams with the purpose of prohibiting any substantial *increase* in the pollutional load and looking to a gradual improvement of the sanitary quality of streams. As a part of this, there are generally provisions that no new industry producing objectional industrial wastes can be established without providing either for discharge into existing municipal sewers or waste treatment works, as a part of the industrial plant, the degree depending upon regimen of the stream. In other words, a new industry or an expanding plant must so treat its wastes that it does not add to the existing pollution load.

Waste Treatment as a Factor In Plant Location

Certain factors have always been important in the selection of plant sites for industry. The more important include:—

A.—Availability of raw materials.
B.—The supply and cost of labor, defining cost not as only wages, but also the very important factor of productivity of labor.
C.—Taxes at the local and state level.
D.—Nearness to markets.
E.—Railroad, truck, and other transportation facilities.
F.—Topographical and sub-soil conditions.
G.—Educational and recreational facilities.
H.—The availability of process water, adequate in quantity and satisfactory in quality.

Now, in recent years something new has been added: The waste disposal problem; in other words, site selection involves picking a site where a solution of the problem of disposing of the liquid wastes can be worked out in a manner acceptable to the health and water quality control authorities without imposing an undue economic burden on the new plant either in capital expenditures or operating costs.

Obviously, there are many industries important to our economy which do not discharge any liquid wastes. These include many types of metal working and wood working shops, the needle trades, shoe shops, etc. On the other hand, the industries which were an important part of the economy of the Northeast and the Southeast (textiles, pulp and paper mills, tanneries, food processing, etc.,) do have to produce liquid wastes.

It is vital that the initial site planning be done with the necessity for treatment in mind. The drains and discharge pipe should be designed to permit easy collection of wastes. Because this has not been done in most existing plants, the capital expenditure for collecting the wastes may well prove greater than that for the treatment plant itself. The cloth scouring process in a woolen mill offers an example of the value of planning for treatment in advance. Here the dirty cloth is first soaped and run through a standing bath in a cloth washer. This bath is discharged and at the same time, continuous flow is run through the washer to wash the cloth. It has been established experimentally at existing mills that a very substantial portion of the pollution is discharged in the first two minutes of a twenty minute rinse. If it is planned initially to have two sets of discharge pipes with proper double valving, then the quantity to be treated is much reduced. A similar result can be effected by double valving the wastes from the dyeing operation. And in general, reduction in the volume to be handled means a reduction in the cost of the treatment works.

It cannot be stressed too often that new plants should be laid out with plenty of space, not only for expansion but for waste treatment. One of the most difficult aspects of designing disposal works in the older plants is this lack of space. As we mentioned earlier, the typical older plant was frequently built to use a water power and crowded into a narrow valley, with the buildings arranged to keep the distance at a minimum that power had to be transmitted mechanically. Usually the city or town was situated in the immediate vicinity of the mill. Space for treatment works is frequently almost impossible to find in these older plants.

The new one story plant with electric power distribution does not have the same limitations. Furthermore, with hard roads and car and bus transportation, plants can be and are being located at a distance from urban areas. The plant site can be selected in the country on a site large enough to permit ample space for all present needs and future expansion. In general, holding tanks, lagoons of some type, and drainage beds constitute the most economical solution of the waste treatment problem, and if these facilities can be located at some distance from the plant, so much the better. Again space is needed for this type of plant layout.

Another important consideration is not to locate what has been well described as, "an elephant of a plant" on a small stream. For instance, in many cases if a dilution of 15 cfs. (10 million gallons per day) per daily ton of production of sulphate pulp is provided in the receiving stream, then conditions in the receiving stream will be satisfactory without treatment. This means that for a 200 ton mill, the receiving stream must have a dry weather flow of 3,000 cfs., or greater. Obviously, if this criteria is applied, the number of locations for 200 ton pulp mills is limited to the relatively few large rivers.

Some discussion of this problem as it affects the woolen and worsted mills may be in order. In the first place the problem of treating wool scouring wastes is most difficult. Not only does the effluent have a very high oxygen demand, but it is very difficult to adequately eliminate the grease from the treated effluent, even with a high degree of treatment, and such a plant would be expensive to build and to operate. The grease has been particularly troublesome if the receiving stream is used for recreation.

The use of water in woolen finishing and dyeing plants is large. An average figure of 5,000 gallons per piece of cloth dyed and finished applies to most mills. On this basis a comparatively small mill will use about 300,000 gallons per day. Many woolen mills have been built on streams so small that substantially all the dry weather flow is used for process and discharged as wastes, leaving no clean water available for dilution.

Another problem relates to the discharge in industrial wastes into municipal sewers. If the amount of wastes produced by the industry is small compared to the total municipal use, and non toxic, then discharge into the municipal system and treatment in the sewage disposal plant constitutes a very satisfactory solution. But as was discussed previously, the amount of wastes produced by an industry is frequently very large and the wastes from a single plant may be greater than the sewage of the town or city. In many cases, industrial wastes have constituents which are toxic, kill the bacteria in the domestic sewage and seriously inhibit the processes of a disposal plant designed primarily for the treatment of domestic sewage. Again, there is need for careful planning in connection with site planning.

In general, however, new industries such as have been discussed, will be located outside of areas served by municipal sewerage systems. So in nearly all cases the solution of the waste disposal problem of a new plant depends upon selecting a site where an economical solution can be worked out, with due regard to the type of treatment required, and the assimilating power of the receiving stream.

Annual NYS and IWA Meeting

Discussions of Plant Operation and Waste Treatment Featured in New York Sessions

President
J. M. MacCrea
Chicago Pump Co.
Syracuse, N.Y.
(Retiring)

President
W. R. Schreiner
State Dept. H'lth
Glens Falls, N.Y.
(Incoming)

THE 24th Annual Meeting of the New York Sewage and Industrial Wastes Assn., in New York City, included a program of technical papers, a panel discussion, and an operators' round table. E. Sherman Chase, Vice President of the FSIWA, was guest speaker at the luncheon. A social hour was provided by courtesy of the Water and Sewage Works Manufacturers Assn. Inc. The two-day meeting, January 17-18, was attended by 275 members and guests.

The Executive Committee of the Association met to transact business, elect new officers, and receive reports of committee chairmen. Plans were made for participation in the 25th Silver Anniversary conference of FSIWA in New York City, October 5-9, 1952. The New York Association will forego its regular spring meeting in view of this meeting of the national association, scheduling a meeting of its Executive Committee at that time. Dr. G. E. Symons, chairman of the convention management committee reported on the organization of plans for the October meeting.

New Officers

New Officers elected to serve until January 1953 are:

President—Walter R. Schreiner, District San. Engr., State Dept. Health, Glens Falls, N. Y.

Vice President—Harry A. Faber, Assoc. Editor, *Water and Sewage Works*, New York, N. Y.

Exec. Secretary—R. C. Sweeny, District San. Engr., State Dept. Health, White Plains, N. Y.

Treasurer—J. C. Brigham, Sr. San. Engr., State Dept. Health, Albany, N. Y.

New Executive Comm. Members—W. L. Edwards, Gowanda State Hospital, Gowanda, N. Y.; A. E. Sparr, Bowery Bay Treatment Works, L. I., N. Y.; and G. B. Wyland, Oneida Ltd., Sherrill, N. Y.

Retiring President John M. MacCrea becomes advisory member of the Executive Committee. William H. Larkin continues as Representative on the Board of Control of FSIWA.

James M. Brown, Jr., San. Engr., Lederle Lab. Div., Amer. Cyan. Co., Pearl River, N. Y., was appointed chairman of the program committee. Marshall E. Ferguson, Field Tech., Interstate San. Comm., New York, continues as chairman of the local arrangements committee.

Awards Presented

The Federation's *Hatfield Award* (for best plant operation report) was presented by Mr. Chase to William L. Edwards, Plant Operator Gowanda State Hospital, Gowanda, N. Y.

Mr. Edwin C. McKeeman, Chairman, Memorial Awards Comm., presented two awards of the New York association:

The *Kenneth Allen Award* (best published technical paper) to Wilbur N. Torpey.

The *Carpenter Award* (best published paper on plant operation) to Nathan I. Kass, Wilbur N. Torpey, A. H. Chasick, Jr., R. C. French, and E. W. Luft.

Chase Recalls "Ghosts"

Guest Speaker E. Sherman Chase reviewed the past, present, and future "ghosts" of sanitation in his luncheon speech.

In 1900, very little had been accomplished in the field of municipal sewage treatment. Typhoid fever was rampant: in the U. S. there were about 35 deaths per year per 100,000 population—or about the same as our current automobile death rate. Baltimore, a city of 0.6 million, had no public sewerage facilities in 1905 (and there were very few sewage treatment plants in the entire country). Cities on the Ohio River were using dilute sewage for public water supplies.

In 1902, the Mass. Institute of Technology established the Lawrence Experiment Station (using funds donated by a woman), and this was rapidly followed by experiment stations built by Columbus, Waterbury, Baltimore, and other cities. The trade-waste problem existed then as now.

The past fifty years has been a period of great public awakening—the U.S. Public Health Service started its long series of investigations, and the applications of chlorine became practical. There were "men of large stature" in the early days of sewage treatment, and the youngsters have now become oldsters. Mr. Chase emphasized the necessity for keeping sewage works in the hands of trained and capable workers.

Federation "Brass"

E. S. Chase
Cons. Engr.
Boston, Mass.
(Vice-Pres.)

W. A. Larkin
State Dept. H'lth
Rensselaer, N.Y.
(Director)

Vice-Pres.
H. A. Faber
Assoc. Editor
W. & S. Wks.
N.Y. City

Secretary
R. C. Sweeney
Dist. Engr.
State Dept. H'lth
White Plains, N.Y.

Technical Program

The program included three technical papers describing the details of effluent chlorination efficiency, ultrasonic vibration applications, and sewage works financing.

Effluent Chlorination

"Efficiency of Effluent Chlorination in the Metropolitan Area" by F. W. Gilcreas, Asst. Dir. in Chg., and W. W. Sanderson, Chemist, Div. of Laboratories, State Dept. of Health, Albany, N.Y.

Twelve regulatory agencies cooperated in setting up a study designed to clarify the factors involved in actual operation of sewage plant effluent chlorination practices. Mr. Sanderson summarized the data obtained in a

carefully standardized and supervised technique utilized by 5 laboratories at 10 treatment plants.

All samples were dechlorinated, cooled, and held at 5° C. until starting the bacteriological examination. The MPN was determined by standard methods, using Difco media, and was carried through confirmed tests. The degree of sewage treatment, prior to chlorination varied widely; from primary treatment to chemical coagulation, activated sludge, modified aeration, and biofiltration.

Results obtained at the Coney Island Treatment plant (chemical coagulation) were cited to illustrate correlation between residual values (after 15 min. contact) and bacterial kill. Before chlorination, the median MPN value for this effluent was 46 million. After chlorination, the median MPN value in thousands was: 240 for samples showing no residual; 78 for samples showing 0.0 to 0.49 ppm. residual; 24 for samples showing 0.5 to 0.99 ppm. residual; 14 for samples showing 1.0 to 1.99 ppm. residual; 9.3 for samples showing 2.0 to 3.4 ppm. residual; 1.8 for samples showing 3.5 to 4.9 ppm. residual; and 14.2 for samples showing 5.0 ppm. residual or greater.

The detailed results from six treatment plants are considered inadequate for drawing significant conclusions (there was, for example, no control of chlorine mixing). Equivalent residuals did not effect similar reductions in MPN values at different plants (at one plant, no advantage was shown by residuals higher than 1.0 ppm.). A committee of the regulatory agencies recommended that the U. S. P. H. S. undertake an investigation to determine if chlorine requirements for effluent disinfection can suitably be measured by the MPN value obtained.

Ultrasonic Potentialities

"Lethal Effects of Ultrasonic Vibrations in Sanitary Engineering Applications" by J. P. Horton, San. Engr., National Research Labs., Oakdale, L. I., D. E. Phinney, Res. Asst., and M. P. Horwood, Prof. of San. Science, Dept. of Civil and San. Eng., MIT, Cambridge, Mass.

Mr. Horton, in presenting his complex data in a most understandable manner, noted that the sanitary engineering profession is increasingly aware of possible applications of ultrasonics. Uses may include coagulation and dispersal of particles, the speeding of chemical reactions and destruction of organisms. Ultrasonic vibrations are those sounds pitched (15,000 to 18,000 per sec.) higher than the human ear can distinguish. Sound intensity can be increased to a point at which it has bactericidal properties.

Three methods to generate liquid-borne sounds, (1) magnetic bar in a magnetic field, (2) crystal expansion and contraction, and (3) the high-velocity jet under development, were described and illustrated. Lantern slides illustrated the equipment used in laboratory studies of the lethal effects of ultrasonics. Important limitations of this application are: (a) the requirement that thin layers of liquid must be utilized (0.5 to 1.0 inch in thickness), and (b) that high surface tension is a disadvantage (generally too high in sewage and industrial wastes).

Costs presently appear fantastic. The cost of electric current alone might be $15,000 per m.g. to sterilize water by means of a quartz crystal ultrasonic generator. The high-velocity jet method may represent an economic advance. However, treatment of milk, vegetables, pharmaceuticals, etc., by ultrasonics involves different cost considerations and may be a practical development.

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Awards Chairman and Awardees

Financing Sewage Works

"A New Approach to Sewage Works Financing" by Morris M. Cohn, Editor, Wastes Engineering, and City Manager, Schenectady, N. Y.

Mr. Cohn reviewed and brought up to date New York State legislation applying to pollution abatement and, more specifically, sewage works financing. Emphasis was placed on the ability of municipalities to pay for sewage works construction. The facts revealed that, in 1950, 331 municipalities had built 291 sewage plants; 569 required pollution control projects, and 262 of these were considered imperative.

Article 8 of the State Constitution says, in effect, that the cost of self-sustaining municipal project (as demonstrated by a year of operation) can be excluded from the bonded debt limitations of the municipality. Obviously, *advance* exclusion of a projected pollution abatement works which would be self-liquidating would enable a municipality to finance construction. A fiscal amendment to the State's Constitution was adopted, and was approved by the electorate last November. It became effective January 1 of this year.

Under the terms of this amendment to Article 8 of the Constitution, a municipality may exclude from its bonded debt limitations 75 per cent of the cost of a self-liquidating project or 75 per cent of the percentage of a project which is self liquidating. Thus, if a community has a debt allowance of $250,000, it can build a million dollar project which would have been constitutionally impossible prior to this new amendment.

A new sewer rental law was enacted by the 1951 Legislature as Article 14 F of the General Municipal Law.

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Section Chief
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H. H. Black
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T. J. Powers
Supt. Wastes
Dow Chem. Co.
Midland, Mich.

C. H. Nichols
Chem. Engr.
Merck & Co.
Rahway, N.J.

Industrial Wastes Panel

Committee Chairmen

J. M. Brown
San. Engr.
Am. Cyanamid Co.
Pearl River, N.Y.
(Program)

M. E. Ferguson
San. Engr.
Int. San. Comm.
N.Y. City
(Arrangements)

This provides a broader and more flexible basis of sewer rents, and separates revenues from these rents into a fund for payment of maintenance, operation, and debt services.

Views on Waste Treatment

"Industrial Waste Treatment is a Point of View"—a panel discussion. Chairman, James M. Brown, Jr., San. Engr., Lederle Lab. Div., Amer. Cyanamid Co., Pearl River, N. Y.

"The Federal Engineer Looks at Waste Treatment" by Hayse H. Black, Chief, Ind. Waste Sec., Survey and Investigation Branch, Public Health Service, Cincinnati, Ohio.

Controlling, reducing, or eliminating industrial waste pollution requires ever-changing methods. Mr. Black emphasized that reduction of waste volume requires good housekeeping—and that the concern of top management is essential. Recovery of specific wastes is feasible: Steffens waste in beet sugar manufacture, and phenols from ammonia still wastes, are examples.

Broadly speaking, our knowledge of domestic sewage treatment is applicable to all industrial wastes containing organic substances. Nevertheless, municipal treatment plants may be disrupted through overloading or toxicity. Industry has recently become more alert to need for pollution abatement and more capable in its accomplishment.

"The State Engineer Looks at Waste Treatment" by R. D. Bates, Chief, Sewage and Ind. Wastes Sec., Bur. of Env. San., State Dept. of Health, Albany, N. Y.

Problems of air, stream, and nuisance industrial wastes generally reduce to the treatment of liquid-borne substances, according to Mr. Bates. The State approach has been to determine the best usage of streams and to classify waters. New York State specifies limiting acceptable qualities for stream waters.

Municipalities and industries must be responsible for meeting established standards of stream quality; some degree of pretreatment of industrial wastes will generally be required if industries are to utilize municipal sewers and sewage treatment facilities. Research projects are clearly needed to determine methods for treatment of specific industrial wastes.

"The Chemical Engineer Looks at Waste Treatment" by C. H. Nichols, Senior Chemical Engineer, Eng. Div., Merck and Co., Rahway, N. J.

Obviously, the most efficient method to prevent waste is to avoid producing waste. The chemical engineer must understand sanitary engineering terms, problems, approaches, and regulations; that is, he must understand more than product manufacture.

Mr. Nichols considers the chemical engineer to be uniquely fitted, through his knowledge of processes, to solve stream pollution problems. Analyses of data are necessary—for the production departments, treatment processes, and receiving streams. Merck and Co. has plants and waste problems in three states. Its management is conscious of waste treatment needs, has spent approximately $2 million, and will spend more to control the problem.

The chemical engineer is particularly suited to solve problems involving toxic wastes, as evaporation methods may be the best approach. Mr. Nichols described investigations of submerged combustion equipment for this purpose: no commercial unit was available, and a device of his firm's own design is now in operation handling about 50,000 gal. of waste per day.

"The Sanitary Engineer Looks at Waste Treatment" by Thomas J. Powers, Supt. of Waste Disposal Div., Dow Chemical Co., Midland, Mich.

The sanitary engineer, said Mr. Powers, has branched away from some other profession and varies in background and function. Whether the sanitary engineer is employed by a control agency, an industry, a municipality, or as a consultant, his primary function is to define a problem—but for each employer he will have a different approach and a different solution.

The control agency engineer should point directions and establish broad goals. He must be impartial and consistent, but not take on his shoulders the problems of other groups. The engineer in industry takes up where the control agency engineer stops: specific problems and objectives must be defined, suitable testing methods developed, and chemists and bacteriologists turned to for detailed assistance.

The municipal engineer, guided by local requirements, may need to set up ordinances, establish charges, and make provisions for the treatment of industrial wastes. These three engineers may further be catalyzed and guided by the broad experience of the consulting engineer. All four gain knowledge by giving and taking information.

Operators' Round Table

"Pumps and Pumping—Sewage, Sludge and Chemicals" was the title of an operators' round table. Chairman of the round table was Uhl T. Mann, Superintendent, Ley Creek Sewage Treatment Plant, Syracuse, N. Y.

Speakers included a consulting engineer, and equipment engineer, and a plant operator:

C. R. Velzy, Engr., Nussbaumer, Clarke & Velzy, New York, N. Y.

D. L. Gallagher, Mgr., Public Works Div., Worthington Pump & Machinery Corp., Harrison, N. J.

J. D. McDonald, Oper., Sewage Treatment Plant, Springfield, Mass.

Mr. Mann introduced the subject by reviewing the basic importance of pumps in sewage treatment. He listed a surprising total of 55 pumps which equip his 9 mgd. activated sludge treatment plant. These pumps are: sewage (9), plunger raw sludge (4), centrifugal raw sludge (2), centrifugal return sludge (6), centrifugal circulating sludge (2), lime (2), ferric chloride (2), sump (4), ground water (3), hydraulic pressure (2), hot water circulating (2), digester heater (2), oil (2), fuel oil (4), condensate (2), vacuum (2), vacuum priming (4), wash water (1).

Mr. Velzy described the two objectives the consulting engineer considers in designing a plant: that the pumps meet the service required, and that the specifications permit reasonable competition. In all instances, there should be a clear understanding of the service to be performed and of the conditions to be met. Some pumps are specialties; in chemical feed pumps, for examples, manufacturers' recommendations should be followed.

Programmers

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Mr. Gallagher emphasized the pump manufacturer's concern with providing the right pump for a specific purpose. Once it is installed, any pump must be properly maintained: it should be overhauled at regular intervals (at least once yearly). Certain spare parts should be provided in the specifications, and a manufacturer's representative should be required to supervise proper installation of every pump.

Mr. McDonald reviewed problems of pump maintenance, pointing out that the 9 unattended pumping stations under his jurisdiction cause more maintenance problems than do all the pumps in his two treatment plants. Experience has shown the need for servicing each station every day—to clean racks and to alternate the sequence of pumping (this prevents deposits accumulating); a storm necessitates a special visit. Water seals have proven inadequate when pumping against too great a head, and grease seals are now used almost exclusively.

Questions from the audience were many and varied—they demonstrated the topic discussed to be of great practical concern. Answers to some of the questions were:

Pump manufacturers can furnish either type of seal (water or grease), water seals *of adequate pressure* being preferable to grease seals for pumping sludge.

Manufacturers vary in recommending sleeve or ball bearings, depending on the relation of bearings to pump design, and either type is satisfactory when used properly.

Operator's Round-Table Panel

Uhl T. Mann
Supt.
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Syracuse, N.Y.

C. R. Velzy
Nussbaumer, Clark & Velzy
New York City

John D. McDonald
Supt.
Treatment Plant
Springfield, Mass.

Dave L. Gallagher
Mgr. Pub. Wks. Div.
Worthington Pump
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In problems of maintenance, prevention is better than cure—this applies especially to lubrication and electrical systems. Particularly vulnerable are copper contacts: silver contacts are only slightly higher in price and are far more permanent. Motor failures are due mostly to moisture and dirt accumulations. Panel boards should never be located over wet wells—in fact, ventilation facilities are generally a standard provision to reduce corrosion hazards. Copper may be protected by thorough cleaning and applying several coats of varnish.

Maintenance is simplified if pumps are coupled as closely as possible to motors. For small pumps (up to 24 in.) manufacturers can, and should, furnish elbows (these will have a large-radius curve to insure smooth flow). Direct drive is to be preferred to gear reduction wherever possible, but cost considerations may be the deciding factor (low speed motors are higher in cost).

The particular application will determine the best pump packing. In a plunger-type pump, a rubber ring may be placed on the bottom and cotton above it (the rubber ring acts as a scavenger and protects against grit).

Repairs made by metallizing and turning down can be very successful, but only capable and experienced firms should be selected to do the job.

Sewer Cleaning Problems

A sound motion picture "Kansas City Flood and Sewer Cleaning Experience" was presented by E. B. Headden, representing the Ace Pipe Cleaning Contractors, Inc., Kansas City, Mo.

Flood conditions and property damage were revealed in scenes from news reels, and then the problems of sewer cleaning were well illustrated. Operations depicted included: locating manholes, power drive for rod and augur, use of a bucket machine, and high pressure water flushing of sewers. The special equipment is operated by specialists.

Milwaukee Gets Tough With Water Delinquents

Finds it Pays Off

A new system was put into effect recently by the Milwaukee Water Department to force delinquents in the payment of water bills to pay up, "or else," according to Water Superintendent Edward F. Tanghe. The new policy, he declares, has influenced tardy payers to come across promptly, and it is saving the city about $12,000 a year, he says. It works this way:

Every water bill sent out by the Department notifies the user of water that a 5% penalty will be added if the bill is not paid within three weeks after the bill reaches the user. Most users pay within the specified time, but those who do not pay in time have had their water supply turned off at the curb. It is only turned on again when the bill, plus the 5% penalty and a $2 service charge, is paid. In recent months about 300 water users have had to pay the extra expense, with much complaint, but the action is in accordance with state law and also complies with a ruling of the Wisconsin Public Service Commission.

According to Superintendent Tanghe, in the past the Department has kept three men on the job all day, calling on delinquents and collecting the payments for water bills, after the due date, with the 5% penalty added. But, the total amounts collected during the year, which sometimes amounted to $10,000 or more, only about equalled the total of the three collectors' salaries. Now such house to house collections of overdue accounts have been discontinued. Instead, men with tools for shutting off the water are now sent where bills are not paid after a second notice. In many cases, Tanghe declares, the sight of the men with the tools induces the delinquent water user to come across with payment of the bill, which might have remained delinquent until a collector had gone to the door several times.—J.E.H.

Ed. Note:—It is apparent that our correspondent does not know that Milwaukee's "new policy" is in fact a very old practice in the collection of delinquent accounts. It is interesting to find that even in these days of easy money that the old rule of "spare the cut off key and spoil the delinquent" is being reproven.

Another Red Faced Water Commissioner

The newspapers of Decatur, Ill., got quite a kick out of publicizing the fact that through oversight one of Decatur's Water Commissioners, Homer Chastain, found himself on the cut off list of the Water Department for failure to pay his water bill. Somewhat red-faced the commissioner hurried to the cashier's window to correct the oversight, but by that time the newspapers had gotten the story. To make it better the story was put out over the AP wires.

Microkjeldahl Procedure in Water and Sewage Analysis

by GEORGE W. REID*, *Assoc. Prof. of Public Health and Sanitary Engineering, The University of Oklahoma, Norman, Oklahoma*

FOR the past four years, the Sanitary Engineering Laboratories of both the Georgia Institute of Technology and the Johns Hopkins University have been using, routinely and successfully, a somewhat unique microprocedure. The procedure has been applied to problems involving the analysis of nitrogen and phosphorous in slime, and of nitrogen in sewage, water, sludge, slime, and algae.[1]

The original studies were initiated to stimulate the use of the microkjeldahl equipment in sanitary engineering laboratories in place of the standard kjeldahl apparatus and procedure, thereby effecting desirable savings in space and installation costs. It was hoped also that some savings in analysis time and in the required amount of attention could be achieved. The microtechnique employed has now been used for making approximately 250 analyses.

Procedure

The Hengar microkjeldahl procedure[2] using 100 ml. flasks was selected as the most suitable method following an extensive search of the literature. In this procedure the sample is digested in a 100 ml Kjeldahl flask which is fitted with a ceramic tube which absorbs vapors liberated during digestion. The distillation procedure is carried out by replacing the ceramic tube with a simple glass air condenser. Throughout the operations, microburners are employed for heating. Selenium crystals are generally used as a catalyst in the nitrogen determination. This choice was made largely because no hood or aspirator would be needed to carry away highly acidic fumes; the Hengar tube employed adsorbs all of the fumes, which may be burned off at infrequent intervals to permit reuse of the tubes. Steps in the procedure were modified slightly, and minor alterations were made to the equipment employed. The use of 21 mm. tubes in place of the usual 15 mm.-

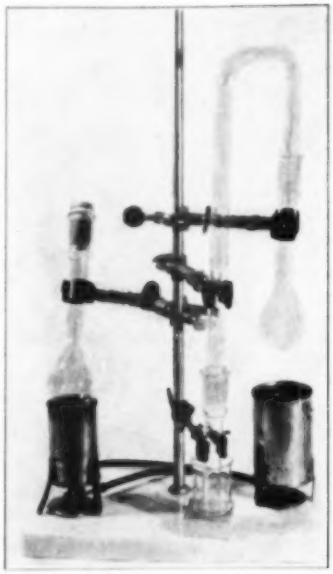

Fig. 1—Hengar Microkjeldahl Equipment.

diameter Hengar tubes made it possible to employ 24/40 standard taper outer joints in the digestion flasks. These joints prove economical in laboratory practice, as they eliminate the most troublesome portion of the technique—the adjustment of the rubber sleeves.

Fig. 2—Infra Red Drying Equipment for digestion of water and sewage samples.

The apparatus employed is pictured in Fig. 1. Special multiple-tube heaters were constructed to dry the samples for digestion; one of these is shown in Fig. 2. For the digestion operation, however, the infrared drier and rack shown in Fig. 2 did not provide sufficient heat; therefore, the use of free flames was necessary. The drier itself has many other uses, as its heat can be regulated in four positions by switching the heating lamps in pairs in either series or parallel.

In Figs. 1 and 3, the flame shields employed can be noted, and in Fig. 3 it can be seen that the flasks used to catch the distillate are mounted on a turntable.

The two steps in the procedure which require the most time and effort are the adjustment of the temperature and the control of the receiving tube assembly in the distillation.

Comparison of Microtechniques and Macrotechniques

A comparative study of the reproducibility of the experimental results obtained for total nitrogen determinations by microtechniques and by macrotechniques was made using (a) a known amount of pure glycine and (b) raw sewage. For the solution of pure glycine, use of the microtechnique yielded results which agreed with the theoretical and which were reproducible within very close limits, as shown in Table I. The results shown in this table, however, may not be typical of the accuracy of such tests when run routinely by a well equipped analytical laboratory, for an all-glass still was used here. It can be concluded, however, that use of the micro-Hengar technique yields excellent results where sampling is not a basic problem. Such is the case for water samples, many stream samples, and perhaps some samples of sludge and slime.

For raw sewage, the average value obtained by use of the macrotechnique is higher than the average microtechnique value; however, the two are in reasonable agreement, as shown in Table II.

A series of analyses was run using each procedure on the same water, sewage, and sludge samples, whose total nitrogen content varied from 1.3 ppm. to 40.6 ppm. Fig. 4 gives a comparison of the data obtained from the use of both procedures. The correlation appears to be good, although

*The author was Project Director, Engineering Experiment Station, Georgia Institute of Technology when the study described in this article was completed.

[1] Data and results of work by L. C. MacMurray will be published shortly.

[2] Henwood, A., and Garey, R. M., "A Modified Technique for the Kjeldahl Procedure," *Journal Franklin Institute, 221,* No. 4, 531-38, April, 1936.

Table I

COMPARISON OF THE RESULTS OF THE ANALYSIS OF A GLYCINE SOLUTION FOR TOTAL NITROGEN USING MACROKJELDAHL AND MICROKJELDAHL TECHNIQUES

Theoretical 50.0 ppm	
Macro-Hengar Technique	Micro-Hengar Technique
50.3	50.0
50.7	51.1
50.3	50.0
50.1	50.0
50.1	49.0
Average 50.3	Average 50.0

greater deviations are apparent at the higher values. Such deviations are probably attributable to the use of smaller samples in the microkjeldahl procedure; the small size of samples is the chief apparent weakness in the use of this technique. The data from macroanalyses shown in Fig. 4 were obtained at the Clayton Sewage Plant in Atlanta, Georgia.

As regards time studies, incidentally, it was found that use of the microtechnique requires approximately the same amount of time as that required for use of the macrotechnique.

It is noteworthy that use of the microtechnique yields lower values than those obtained using the macrotechnique when the conventional apparatus for the former is employed, although use of the all-glass macrotechnique apparatus yielded values lower than those obtained from the microtechnique, as shown in Table II.

Table II

COMPARISON OF RESULTS OF THE ANALYSIS OF RAW SEWAGE FOR TOTAL NITROGEN USING MACROKJELDAHL AND MICROKJELDAHL TECHNIQUES

Macrotechnique	Microtechnique
33.9	30.9
34.5	30.9
33.7	30.9
34.3	30.9
32.8	30.9
31.5	32.0
33.5 Average	Average 31.1

Slime Studies

The microkjeldahl technique is very useful in other sanitary engineering studies. In a research program at Johns Hopkins University, for example, it became necessary to develop a procedure for analyzing bacterial slimes for phosphorous and nitrogen. The slimes were grown on glass microscope slides and were successfully analyzed for nitrogen by the Hengar microkjeldahl technique.

The slime was removed from the slide with hot acid and digested in the Hengar flask. An aliquot was then removed for the test for phosphorous, and the remainder was air distilled into Nessler's reagent. Both the nitrogen and phosphorous values obtained were consistent within a probable error of one per cent.[3] In this instance, where the same digested sample was used for analysis of both phosphorous and nitrogen, it was necessary to leave out the selenium—as selenium interferes with the colorimetric determination of phosphorous. Glass beads were used to prevent bumping.

Of interest in these studies was the fact that analyses of slimes for radiophosphorous, inasmuch as the equipment needed is quite small and compact, were carried on in a small space, which was easily shielded.[4] MacMurray has used the technique to determine total nitrigen in algae and has found it quite successful.[5]

Cost Study

Catalogues of scientific apparatus list a very wide variety of kjeldahl equipment. In general, the macrokjeldahl technique, using 500 or 800 ml flasks, requires either a hood or a special aspirator device, though Hengar tubes are available. For distillation, a water condenser is usually necessary. A comparison of equipment costs is shown in Table III.

Table III

COMPARISON OF THE COST OF VARIOUS KJELDAHL ASSEMBLIES

Capacity	Limit	Cost Unit	Remarks
100 ml	Hengar unit complete	$24.25	Twin unit
100 ml	Hengar unit assembled	11.25*	Using all std. equipment
10–30 ml	Micro	6.00	Unit of six
500 ml	Macro	95.75	Twin portable units and water aspirator
500 ml	Macro	16.00	All glass using Hengar tube for digestion

*Use of standard taper will increase the price $4.00.

These figures show that, when standard taper glassware is employed, the 500 and 100 ml. assemblies compare very favorably in cost. However, in commercially available complete

[3] The phosphorous analytical technique employed was that of *Summer's Science 100*. 413 (1944).

[4] JHUX-2 "Adsorption and Assimilation by Bacterial Slimes of P^{32}" by G. W. Reid.

[5] Personal communication.

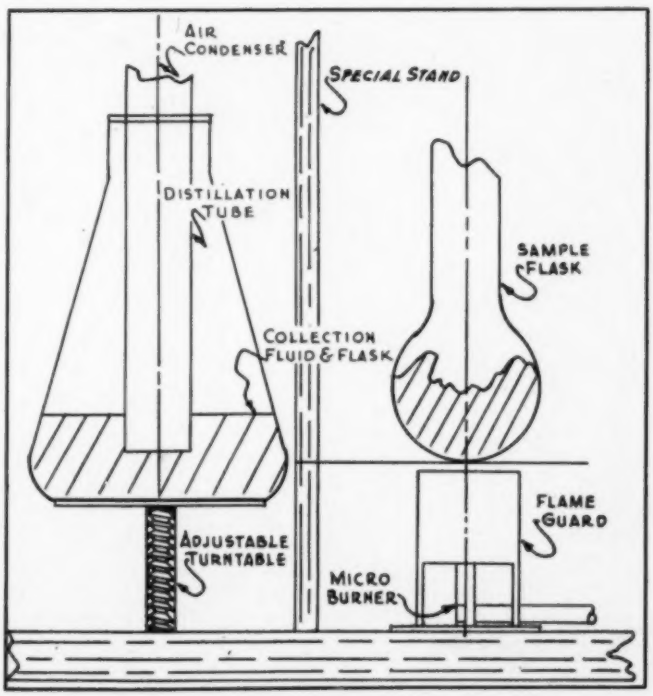

Fig. 3—Diagramatic Arrangement of Equipment for distillation procedure.

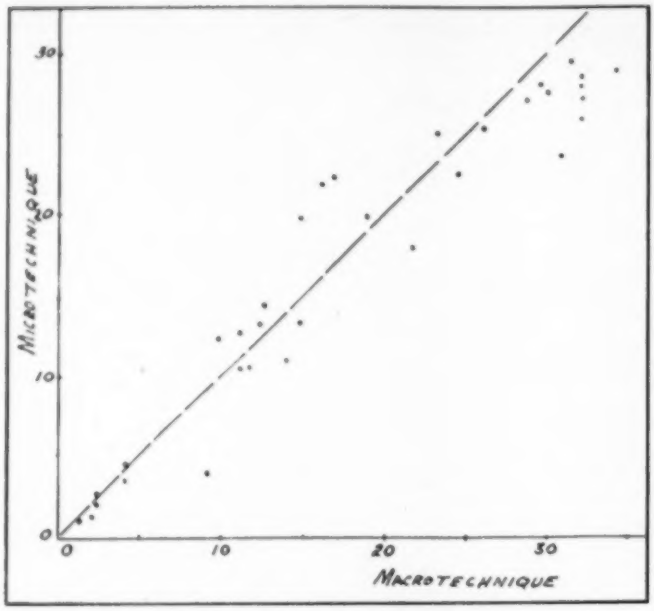

Fig. 4—Comparison of Microtechnique and Macrotechnique in determination of Total Nitrogen in Water, Sewage, and Sludge Samples.

units, the 500 ml. assembly is about four times as costly as the 100 ml. assembly.

Conclusions

The microkjeldahl technique has been found reliable and useful. The use of standard taper joints and special racks has made the equipment easier to manipulate. This technique should prove particularly useful to laboratories where space is at a premium and when the accuracy of sampling is not too serious a problem. Of importance, also, is the fact that the comparative cost of the equipment for the microtechnique is approximately one-fourth of that for the macrotechnique.

Acknowledgments

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125 Million Required to Clean-Up Boundary Waters

U.S. and Canada in Anti-pollution Pact

Canada and the United States have given the International Joint Commission the green light to develop a $125,000,000 program to control and prevent pollution of the boundary waters between the two nations.

The commission having studied the pollution situation since 1946, with particular reference to the conditions of the Detroit River and the Niagara River, has analyzed waste disposal practices and problems of some 60 municipalities and 100 industrial plants. More than 100,000 tests of water quality in the boundary waters has been made. The report and recommendations of the Technical Committee of the Commission was published in 1951. It contains recommended water quality standards which are to be considered "tentative" and subject to revision as developments warrant. An estimated expenditure required of municipalities and industry in the pollution abatement program recommended will run to $125,000,000 in addition to what has already been spent by Detroit, Buffalo and other municipalities, as well as several industrial plants, on the boundary waters for sewage treatments.

Sanitary Sewers at Unusual Depths in Shale and Rock

By GEORGE W. McGRATH,
Sanitary Engineer, Rich Plumbing Co., New York City

CUTTING through hard clay, shale and rock, often over 25 feet below ground level, we are installing some 900,000 feet of vitrified clay pipe for the sanitary lines that will serve the Veterans Administration Hospital under construction on the old university grounds, about 1100 feet above the famed "Golden Triangle," in Pittsburgh, Pa.

The Veteran's Hospital is a $14,000,000 structure designed for eventual 1,000 bed capacity, but being built, at present, for 750 beds. It was begun in November, 1950, and is scheduled for completion by the end of 1952.

Our contract covers all phases of sanitary line construction, water distribution, heating, etc., for the plant and grounds, for $2,500,000. It might be interesting to note in passing that the ideal site was acquired by filling an old mine shaft with concrete at a cost of about $800,000 for the job. The mine was vented and passed engineers' approval before the building was begun.

We had to use blasting, and considerable air-powered digging, to ditch for the sanitary lines and some dozen manholes, averaging about 27 feet in depth. These deep manholes, of three different types were constructed of reinforced concrete.

Vitrified clay pipe was employed for the sanitary lines. Pipe sizes ranged from 10-inch to 21-inch, with the total 900,000 feet roughly approximately the following percentages: 50% of 18-inch pipe; 20% of 12-inch pipe; and 15% each of 21-inch and 10-inch pipe.

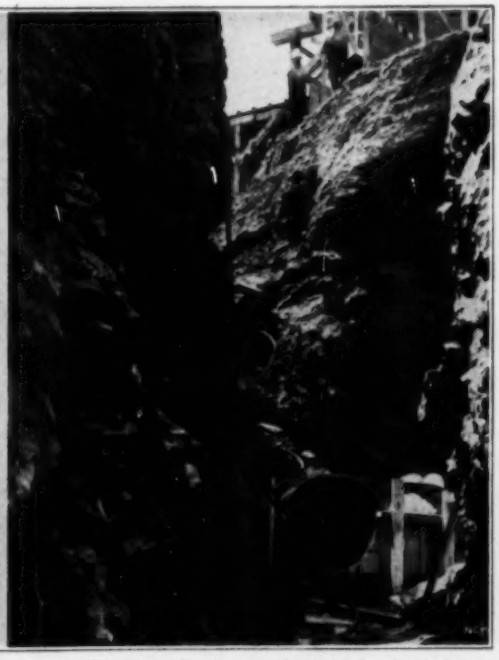
Government engineers, officials, architects and engineers on the construction job concurred that clay pipe, properly joined, permitted the most speed and ease in installation; low original cost; and maintenance economy, as compared to other materials and methods that would be required under the unusual digging conditions.

In the plant proper, cast iron pipe was specified to meet the city building code of Pittsburgh. The 6-inch and 8-inch branches of cast iron pipe feed into 10-inch and 12-inch vitrified clay lines.

We are installing 12 manholes, of three different types—so-called Class A, Class B or two-way invert, and drop manholes. Depths exceeding 13½ feet had wall thickness increased from eight or nine inches, to 18 inches.

Among the United States Corps of Engineers present is one of the leading specialists in Veterans Hospitals construction, Harry King; the entire construction is under the Department of the Army, Corps of Engineers, Pittsburgh District. Architects who collaborated on the hospital, all of Associated Architects, of New York and Pittsburgh, include Mitchell & Ritchey, Altenhof & Bown (stet.) Ingham, Boyd & Pratt, and York & Sawyer.

BEDDING and stabilizing 18" clay pipe with air-powered tamper. Manhole being built in background.



ROUGH GOING, constructing sewer in 27 ft. of rock and shale. Manhole form in first stage.

Report from Abroad

Water Pollution Research in Great Britain and Nottingham Sewage Farms

by JOHN FINCH, *Manager, Sewage Disposal Dept., Rotherham, England*

Water Pollution Research

The Report of the Director of Water Pollution Research, Dr. B. A. Southgate, for the year 1950 has recently been published and includes brief accounts of the chief investigations made during the year. These were concerned mainly with the development or improvement of methods of treatment of sewage and industrial wastes. The three major items of interest were the continuation of the Minworth (Birmingham) high rate single filtration experiment, the mechanical filtration of sewage effluent, and the treatment by biological filtration of sewage containing (a) spent gas liquor, and (b) various fractions of crude gas liquor.

The work has been continued at Minworth (until June 1950) on the treatment of settled sewage in percolating filters at rates very much higher than normal (100 to 1,000 gal. per cube yard per day). There were 8 filters involved in this investigation, all being 8 feet deep; 7 of the filters were filled with crushed gravel graded ¾ in. to 1½ in. in size, the other one being filled with smooth gravel graded 1½ in. to 3 in. in size. The average results of the operation of these filters from December 1949 to June 1950 (the period covered by the Annual Report) show that the B.O.D. of the filter effluent after quiescent settlement for one hour varied from about 25 ppm. at 100 gal. per cube yard per day to 63 ppm. at 1,000 gal. per cube yard per day. These results were produced with a feed of settled sewage having a B.O.D. of 162 ppm. Effluent from the filter containing coarse gravel and operated at 600 gallons per cube yard per day had a B.O.D. approximately the same as that of the effluent from the filter containing smaller gravel and operated at 800 gallons per cube yard per day.

With increasing rates of treatment the proportion of the B.O.D. removed by biological filtration decreased, but the total weight of B.O.D. removed increased markedly; the weight of B.O.D. removed, per cubic yard of medium per day, being nearly eight times as much at 1,000 gallons per cube yard per day as at 100 gallons per cube yard per day.

From the beginning of the period covered by the Report ponding occurred on the surface of most of the experimental filters, and the surface layer of gravel on the ponded filters was forked on many occasions. No forking was necessary, however, on the filter which contained large gravel and which was operated at 600 gallons per cube yard per day; the filter which contained the smaller gravel and which was operated at the same rate had to be forked on 10 occasions up to June 1950.

To many sewage works operators, the work being done on the effects of fractions of gas liquor on the treatment of settled sewage by the Water Pollution Research Board in collaboration with the Gas Research Board, is the most important aspect of the whole year's programme and the reason is not far to seek. In most inland towns in Great Britain, spent gas liquors from the manufacture of gas are treated in admixture with sewage at the sewage disposal works, and where the proportion of liquor is unusually high serious difficulties may be caused in the treatment of the mixture.

Since the nationalization of the gas industry in Great Britain about two years ago, the policy of the newly formed Board has been a distinct tendency towards centralization, especially in the industrial areas, and this has caused many heartburnings to those local authorities faced with a major gas-liquor disposal problem at the sewage treatment plant.

It should of course be explained that, under Act of Parliament (The Public Health Drainage of Trade Premises Act of 1937), a local authority cannot refuse to accept gas-liquor into its sewers for treatment at the sewage works. But the authority can impose upon the Gas Board conditions of acceptance requiring the pre-treatment of the gas-liquor, and can also make a charge for the treatment of the liquor at the sewage treatment plant. In the event of agreement not being reached by the local authority and the Gas Board, then the whole matter may be referred by the Gas Board for arbitration to the Ministry of Local Government and Planning.

In this matter of pre-treatment, the gas industry in the past has usually removed ammonia from the crude liquor to produce "spent" liquor and discharged this material to the sewer. On occasion the monohydric phenols have also been removed by extracting with a light creosote oil or with benzene. Starting with a crude gas-liquor having an oxygen consumed value of around 20,000 ppm., the removal of the ammonia has resulted in this value being reduced to about 10,000 to 12,000 ppm. and to about 5,000-6,000 ppm. in the case of dephenolation. The sewage treatment authority is then left with the residuals which contain concentrations of polluting substances difficult and expensive to remove or destroy by whatever methods may be adopted—either at the gas works or at the sewage treatment works. It is therefore quite obvious that whilst sewage treatment authorities are keenly interested in the fractionating experiments and the substances the Gas Board intend to remove from the gas-liquor as a result of their researches, they are more vitally concerned with those substances the Gas Board is likely to leave in the gas-liquor discharged to the public sewers for treatment.

To date, trials with treatment of the fractions of crude liquor have been made in small percolating filters. The greatest deterioration in the quality of the sewage effluent

The *Report from Abroad* will continue to present topics and opinions of timely interest. Mr. Finch is Chairman of the North Eastern Branch of the Institute of Sewage Purification, and is a frequent contributor to British technical journals. He will welcome the opportunity of replying personally to readers of *Water and Sewage Works* who have questions or require additional information regarding the subjects discussed.—The Editors.

was caused by the addition of two fractions, one containing thiocyanate, ammonia and organic substances not extracted from the crude liquor by methyl isobutyl ketone; the other fraction containing carboxylic acids and "humic" acids. Of the four fractions into which the phenols were divided, the two containing polyhydric phenols caused a significantly greater deterioration in the quality of the effluent (as measured by the test for oxygen absorbed from permanganate) than did the two containing monohydric phenols, but the effect of all four fractions on the B.O.D. of the effluent was very similar.

The Nottingham Report and Green Algal Growths

I recently received a copy of the 1950 Annual Report of the manager of the Nottingham Sewage Department, Mr. A. R. Stone. The Nottingham undertaking, one of the few remaining sewage farms in Great Britain, deals with the domestic and industrial sewage from a population of about 370,000 persons. The population equivalent loading of the industrial effluent discharged to the sewers is such as to bring this figure up to a total loading, domestic and industrial, of about 600,000 persons. The flows represented by this loading vary between 11.1 mgd. and 43.7 mgd. The average quantity of sewage treated, when related to the actual population draining, represents 58.3 gallons per head per day, and this quantity is high when compared with other cities in Great Britain, being so by reason that bleaching, dyeing, tanning, plating, chemical and gas manufacture are the chief local industries from which liquid wastes are derived.

Mr. Stone states in his report that the purification of the sewage before passing to the River Trent has presented a vast problem owing to the areas under irrigation being overloaded, but that successful efforts have been made to cultivate in tanks and huge lagoons a natural green algae which assists materially in the sewage purification process wherever it has been applied to the liquid. He further states that the greatly improved condition of the River Trent below Stoke Bardolph has resulted from the inclusion in the river of sewage which has been treated by this unique process.

This is perhaps the most interesting and most significant statement in Mr. Stone's report.

It has been customary at Nottingham in recent years to keep about 700 acres of land under irrigation at one time. The average flow is around 21 mgd. and the average B.O.D. of the settled sewage is about 188 ppm. The changes occurring on the surface when about 21 mgd. of settled sewage are spread over about 700 acres of practically level ground are most diverse, and include not only septicity but the development of chlorophyll-containing microorganisms. In 1947 the idea was conceived of encouraging green algae in the hope that the dissolved oxygen produced during the day would assist purification or at least reduce nuisance. In the spring of 1948 and 1949, using such primary tanks as could be spared, settled sewage was exposed until it became green, and part of this green liquid was pumped to the irrigation areas to inoculate the settled sewage being treated there. The remaining green liquid was used to seed further settled sewage.

The decision to encourage the growth of microscopic green organisms was conditioned by the fact that this seemed the only unexplored avenue for improving the character of the effluent from the Nottingham sewage works pending the installation of modern plant. The Nottingham workers are satisfied that the results obtained have materially overcome many of the difficulties experienced in a much overloaded irrigation system.

The discussion of the paper published in 1950, and the particular references to green algal growths, was very brisk and was carried on almost unabated on account of the revolutionary character of the authors work. Interestingly enough, Dr. Butcher, Chief of the Trent River Board, the concerned authority so far as the Nottingham final effluent is affected, proposed the vote of thanks to Messrs. Stone and Abbott for their work and did so in glowing terms as a sincere supporter and advocate. More interesting is the fact that one of the workers, W. E. Abbott, has now gone to an appointment with Dr. Butcher, and there is no doubt that Abbott's considerable knowledge of this development will be focussed on the problems of purification. It is confidently anticipated that more will be heard on green algal growths from the laboratories of the Trent River Board.

Sewage Treatment Topics from "North of the Border"

A meeting of exceptional interest took place on November 8th in Glasgow, without a doubt making history in the sphere of sewage treatment practice, and I am greatly indebted to a friend and colleague, James McNicholas, Manager of the Motherwell Sewage Plant and Honorary Secretary of the Scottish Branch of the Institute of Sewage Purification, for the details of this event.

The meeting was devoted to a talk on "Reminiscences of Sewage Disposal in Scotland" by Mr. J. A. Warren, a 91 year old Consulting Engineer practicing in Glasgow, and important was the occasion because Mr. Warren had his first introduction to the science of sewage treatment as far back as 1877 when he was serving his Articles. Mr. Warren has therefore lived through the whole period of development of the practice of sewage treatment and has been in intimate contact with many characters, famous in the field, including such personages as W. J. Dibdin, Members of the Royal Commission on Sewage Disposal and many other pioneers. Furthermore Mr. Warren's length and breadth of experience in the art of sewage treatment must be unique in Great Britain, if not in the world.

When one considers the changes that have occurred in sewage treatment practice since the year 1877, which incidentally was about the year in which Dibdin first entered the sewage field, then, and only then, does one fully realize the import of the depth of Mr. Warren's rich experience.

Many engineers and sewage works operators well remember the Annual Conference of the Institute of Sewage Purification which was held in Glasgow in 1947, and also remember that up in Scotland are some of the best designed and most modern sewage treatment plants in Great Britain. Two years ago I was included in a party visiting some of the sewage treatment works situated in the Glasgow area and had the opportunity of discussing sewage treatment problems with the staff of the Lanarkshire County Council Drainage Committee.

The population of the County landward area is about 320,000. The County Council have 7 works on the activated sludge principle, around 24 or 25 complete filter plants and something over 20 partial treatment plants. The great work being done by Lanarkshire County Council Drainage Committee is the admiration of all concerned in sewage treatment practice, and much of the valuable information so freely given by these experts during the course of discussions on my visit to their headquarters proved to be of the greatest value when facing up at a later date to the design of a modern plant.

Speed Chart

for Water & Sewage Works

Contributed by

W. F. Schaphorst, M.E., Newark, N.J.

This chart has an almost endless number of applications in and around the water works plant for determining ordinary and extraordinary speeds. Where desired, its use may assist in speeding up conditions.

As every reader has doubtless observed, the speeds that are generally used in water works plants are in terms of feet per minute or per second or in rpm. We are left to "guess" as to miles per hour speeds or we must compute them laboriously in longhand or with a slide rule.

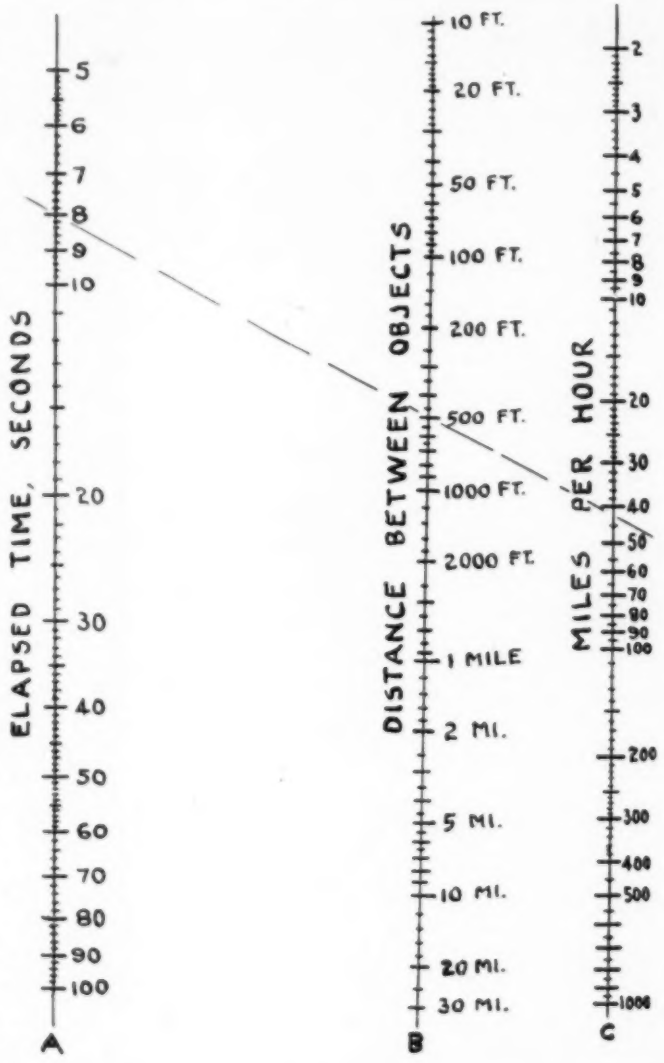
Charts giving feet per minute, such as water flow in pipes, are more or less common, but this writer has never seen a chart that gives miles per hour, so he developed this one.

For example, let us say that in your plant you have a coal conveying belt and you find that a given lump of coal on it travels between two fixed points in 8 seconds. You also find that the two points are 500 ft. apart. What is the speed of the belt?

The dotted line drawn across the chart shows how easily the problem is solved. Simply lay a ruler or straightedge across the chart, through the elapsed time, column **A**, and through the distance between the fixed points, column **B**, and the answer is instantly found in column **C**.

The columns are read in the same way that you read an ordinary thermometer. Thus, roughly, you would say that the dotted line cuts column **C** at 43, which means that the speed of the coal conveyor is 43 miles per hour.

As will be noted, the range of the chart is extremely wide—from 2 miles per hour to 1,000 miles per hour. But in addition its range can be extended indefinitely for lower or higher speeds by merely shifting decimal points. Thus, for example, if you should toss a piece of paper into a river at its center and find that the paper moves 500 ft. in 80 seconds, the same dotted line drawn across the chart tells us that the river at its center flows at 4.3 miles per hour. Or if it takes 800 seconds to cover the same distance, the speed is 0.43 mile per hour. In other words, simply move the decimal point in column **C** as many places to the left as you move the point in column **A** to the right.



Ed. Note: This chart will also reveal the distance an object will travel in any given time if the speed in miles per hour is known. For example: at 10 mi./hr., in 1 minute (60 sec.) the line from 10 mi./hr. to 60 sec. passes through 900 ft. on "B" as the distance per minute. Or, if the speed is 35 mi./hr. and you wish to know how many seconds will be required for the object to travel 1000 ft. the line from 35 m.p.h. through 1000 ft. on "B" passes through 20 sec. on "A." The nomograph may be checked for accuracy by observing that the line from 1 min. (60 sec.) on "A" to 60 m.p.h. on "C" passes through the 1 mile mark on "B."

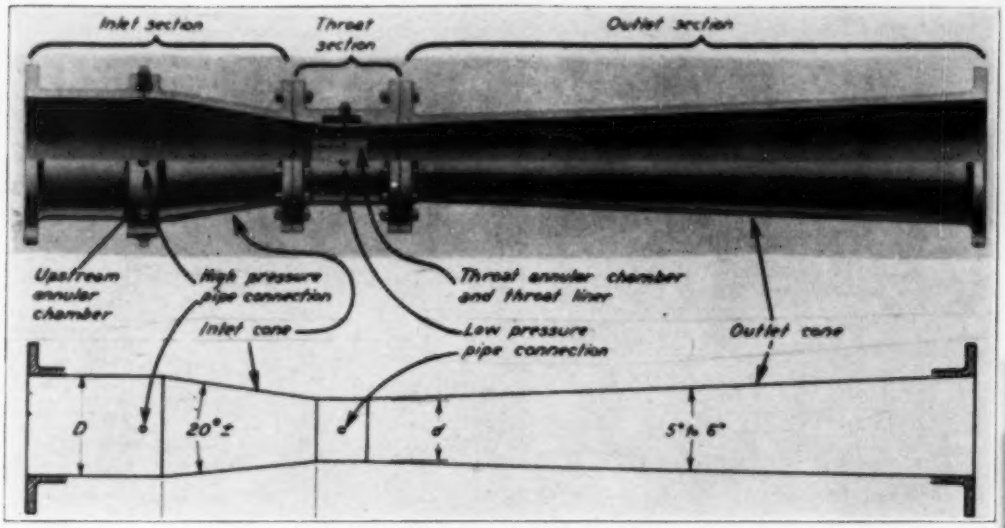


Fig. 1—Herschel standard "long" Venturi meter tube.

Meters, Tests and Records are Important to Sewage Works*

by GERALD E. RIEPE, *Engineer, Builders-Providence, Inc., Wilmette, Ill.*

WHETHER you operate a large and complicated sewage treatment works or a simple primary treatment plant for a small village, it is important to know what your sewage works is doing, and how well or how poorly it is doing the job. It is important to the superintendent or operator; it is important to the city officials; it is important to the citizens and taxpayers; and it is important to local and state health officials. Many reasons may be cited to show why it is important to each of these persons or groups for the operator to know what his plant is doing.

It is not the purpose of this paper to delve into these detailed reasons, except to say that complete knowledge of how a sewage works is operating is important for the sake of the health of the community, for the sake of reducing operating costs and hence taxes, for improving operation, for educating the operator, and for increasing the pride he should have in a job well done. Rather, the purpose of this paper is to discuss ways and means of keeping tab on plant operation and the importance of these means at your disposal.

There are three avenues of approach to knowledge of how a plant is operating.

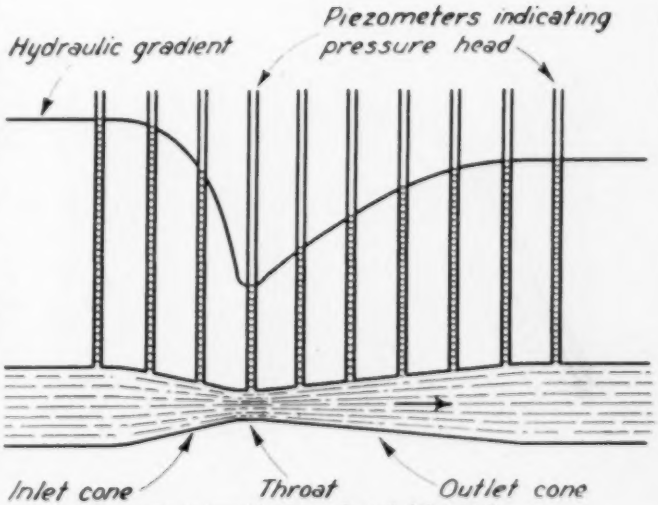


Fig. 2—Loss of head curve for typical Venturi tube

*A paper presented at the Rocky Mountain Sewage Works Assn. and released for publication in *Water & Sewage Works.*

Fig. 3—Kennison Nozzle

These are: (1) Physical measurement of volumes and weights of sewage and materials handled, as well as of power and energy and dollars expended; (2) Analysis of the composition and concentration of liquids and solids passing through the plant and the determination of the changes therein; and (3) the recording of all of these data with the calculation of operating efficiencies, results, and costs of operation as permanent records of operating accomplishment.

Within a limited space, it is impossible to elaborate fully on all of these three phases. It is well known that unless what goes through a plant has been completely and correctly measured, all the tests one may possibly make and all the records one can find time to keep will be of little value. For that reason, it is proposed to devote most of this paper to the subject of measurements and metering, how they should be done and why they are so important. This discussion, too, will be confined principally to normal sewage treatment plants for communities of average size.

Measurements and Metering

In any sewage plant, measurements are made of liquids, solids, gases, and electricity. In general, there are several ways of doing each.

Liquid Measurement

Probably the most important single measurement is that of volume or flow of sewage being treated. It is essential to know continuously, and not to guess, the performance of the whole plant as well as the individual units of treatment. Such knowledge may be assured only if the volume of sewage passing through the plant or through a single unit of treatment is known. It is also essential that the operator know how much, if any, sewage is by-passed during storm flow run-off if the city has combined sewers.

The flow of sewage into a plant may be measured in three ways, by Venturi tube (and meter), by Parshall Flume, and by Kennison Nozzle. The mere use of these devices by themselves is not sufficient. There must, of course, be accompanying gauges and recorders which will be described later. (It is also possible to measure sewage flow by weirs, but this method is infrequently used in sewage treatment plants.)

For the larger sewage works, the Venturi Tube and its accompanying meters are most suitable. The Venturi tube consists of two cones facing in opposite directions and attached to a short throat as shown in Fig. 1. The inlet cone is more steeply shaped and is shorter than the outlet cone.

This device operates on the principle that when the size of the pipe is restricted, the velocity of the liquid passing through it increases and the head (or height the liquid will rise above it) decreases. The difference in the head at the throat and at the inlet is a function of the volume of liquid flowing through. This principle is illustrated in Fig. 2. In addition to the fact that the Venturi Tube offers little or no resistance to the passage of fairly large objects as are often found in sewage, there is also very little head loss through the Venturi Tube, and the accuracy of a good Venturi Meter is of the order of one per cent.

In smaller plants, sewage flow may be measured by the Kennison Nozzle (shown in Fig. 3), which has the additional advan-

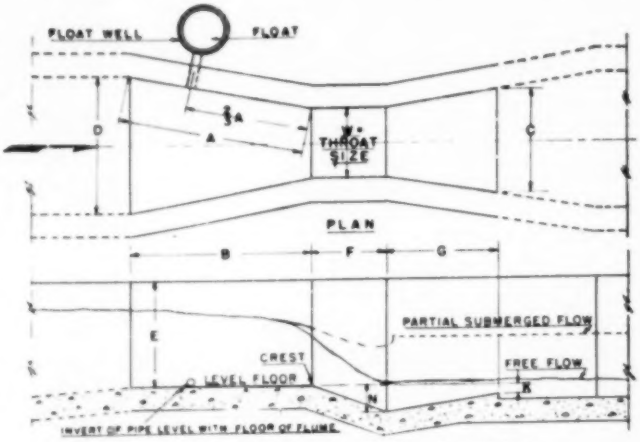


Fig 4—Diagram of Parshall Flume of "Open Type Venturi"

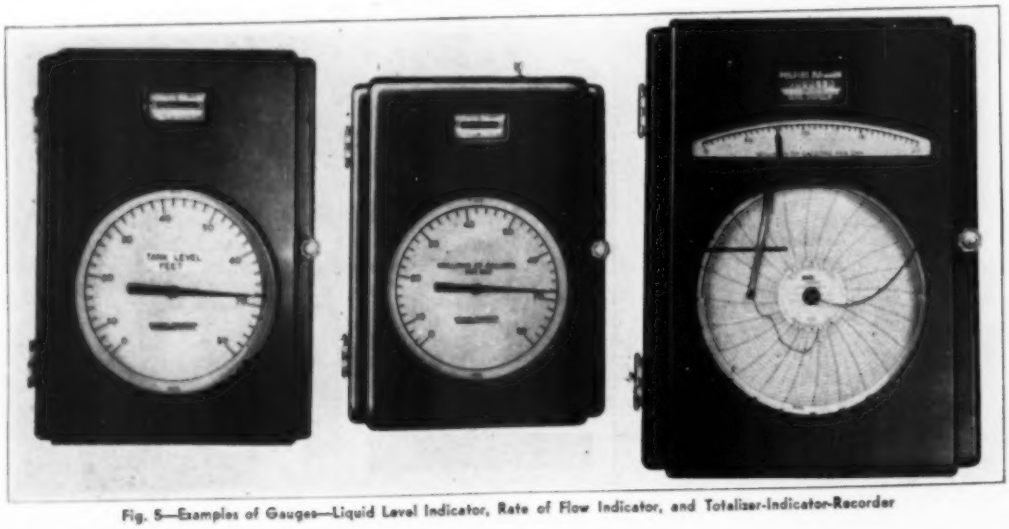


Fig. 5—Examples of Gauges—Liquid Level Indicator, Rate of Flow Indicator, and Totalizer-Indicator-Recorder

tage of being useful for the purpose of controlling the flow in a grit chamber to the proper velocity desired. It, too, has an exceptional accuracy.

Another primary measuring device used in small sewage works is the Parshall Flume, which is in effect an open Venturi tube as shown in Fig. 4.

All of these measuring units have the advantage that by means of the proper connection with control devices, it is possible to operate many appurtenances in the plant in accordance with the flow of sewage. Such things as chemical feed machines, pumps, chlorinators, air blowers, etc., may be operated in direct ratio to and paced by the metering devices. This "pacing" operation of various units from measuring devices is a fascinating subject in itself, but cannot be covered here.

Recording Devices

Obviously, the mere measurement of any liquid in motion is of little value unless some record of that measurement is made. For that purpose, there are recording instruments which will show at what rate the liquid is flowing. These are the indicating gauges; they only show what is happpening at that moment. But the operator wants a record of what has happened, so there is available the indicating-recording type of meter which shows what is happening at the moment as well as recording it on a chart for permanency. A year later an operator can compare the sewage flow as it was then with what it is today.

A more complex, but a more useful recording gauge, is that which not only indicates and records, but also totalizes. This is the totalizing-indicating-recording meter, which will give at the end of 24 hours (or any other period of time) the actual amount of liquid that has passed through a plant or part thereof. These are permanent records (with a high degree of accuracy). They can be used for any purpose, from a simple record of operation to exhibits in a lawsuit, in case one should arise. Examples of these gauges are shown in Fig. 5.

What Liquid Volumes to Measure

What liquids does one measure and where does one make the measurements? Probably no two designing engineers would fully agree on the proper points of location for meters and controllers. However, inasmuch as such devices cost but a fraction of the cost of the whole plant, there is both logic and common sense in "complete metering." In the well-operated plant there is not only the aim to reach and maintain the highest efficiency but also to experiment constantly to lower the cost of operation per unit volume of flow (i.e., per million gallons). Manifestly, it is essential to *know* continuously and *not to guess* the performance of the plant as a whole and its individual units. Thus again it may be said that complete metering is the ideal of good design.

Whether or not complete metering is obtainable may sometimes be dependent on monies available or other circumstances, and it is well to look briefly at the principal points of measurement and what should be measured or metered. Undoubtedly, the most important single measurement is that of the volume of liquid sewage coming into the plant. Therefore, a measuring device (Venturi, Kennison Nozzle, or Parshall Flume) should be placed at the influent to the plant. Circumstances of topography, design, whether or not the sewage must be pumped and other factors dictate the details of location. Measurement may take place before or after grit channels, but where pumping is necessary, the measuring device is usually located on the discharge side of the pumps.

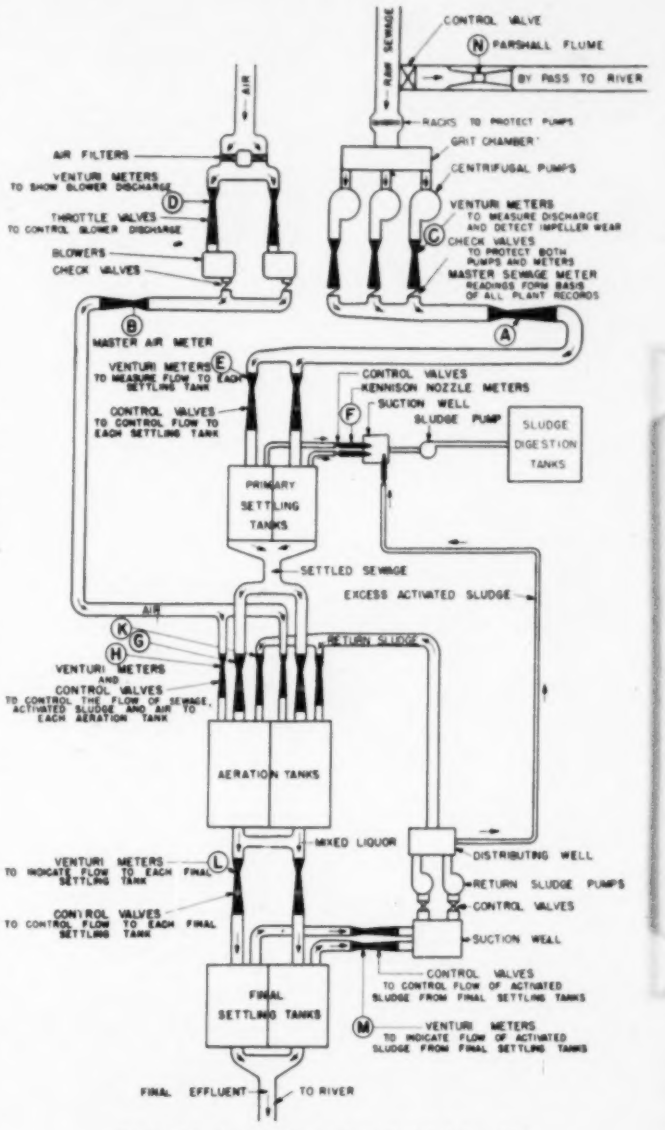

CONTROL VALVE
N PARSHALL FLUME
BY PASS TO RIVER
RACKS TO PROTECT PUMPS
GRIT CHAMBER
CENTRIFUGAL PUMPS
VENTURI METERS TO MEASURE DISCHARGE AND DETECT IMPELLER WEAR
CHECK VALVES TO PROTECT BOTH PUMPS AND METERS
MASTER SEWAGE METER READINGS FORM BASIS OF ALL PLANT RECORDS
AIR
AIR FILTERS
VENTURI METERS TO SHOW BLOWER DISCHARGE
D
THROTTLE VALVES TO CONTROL BLOWER DISCHARGE
BLOWERS
CHECK VALVES
B MASTER AIR METER
A
VENTURI METERS TO MEASURE FLOW TO EACH SETTLING TANK
E
CONTROL VALVES TO CONTROL FLOW TO EACH SETTLING TANK
CONTROL VALVES KENNISON NOZZLE METERS
F SUCTION WELL SLUDGE PUMP
SLUDGE DIGESTION TANKS
PRIMARY SETTLING TANKS
SETTLED SEWAGE
EXCESS ACTIVATED SLUDGE
AIR
K
G
H
RETURN SLUDGE
VENTURI METERS AND CONTROL VALVES TO CONTROL THE FLOW OF SEWAGE, ACTIVATED SLUDGE AND AIR TO EACH AERATION TANK
AERATION TANKS
MIXED LIQUOR
DISTRIBUTING WELL
VENTURI METERS TO INDICATE FLOW TO EACH FINAL SETTLING TANK
L
RETURN SLUDGE PUMPS
CONTROL VALVES TO CONTROL FLOW TO EACH FINAL SETTLING TANK
CONTROL VALVES
SUCTION WELL
CONTROL VALVES TO CONTROL FLOW OF ACTIVATED SLUDGE FROM FINAL SETTLING TANKS
FINAL SETTLING TANKS
M VENTURI METERS TO INDICATE FLOW OF ACTIVATED SLUDGE FROM FINAL SETTLING TANKS
FINAL EFFLUENT
TO RIVER

Fig. 6—Meter location diagram for activated sludge plant.

For all intents and purposes, the same amount of liquid leaves the plant as enters it, so it is not necessary to measure the effluent of the plant. On the other hand, some of the liquid is removed with the sludge which settles out in a primary treatment plant. Where that sludge is treated or allowed to digest in a separate digestion tank, it is necessary to know how much raw sludge enters those tanks and how much digested sludge leaves the tanks.

If the sludge is pumped, it is best measured by Venturi meters especially designed for the handling of sewage sludge. The Kennison Nozzle can also be used, but the Parshall Flume is not applicable for this purpose. Sometimes sludge volumes into or out of digestion or storage tanks are determined by the rise or fall in liquid level in the tank. For this purpose, level gauges, with indicators and recorders are available. Regardless of ultimate disposal (sand beds, lagoons or incineration), a knowledge of the amount of sludge is highly desirable.

Where secondary treatment is practiced, the volume of sludge obtained and returned to the process should be determined. It is

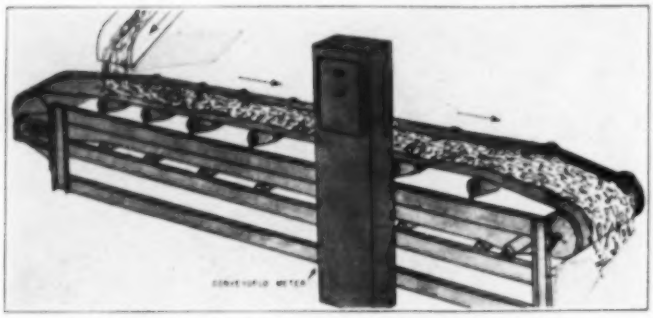


Fig. 7—Conveyoflo Meter for continuous weighing of sludge filter cake.

also desirable to measure the volume of sludge from final settling tanks following trickling filters as well as activated sludge plants. Perhaps the most complex and the most complete metering is essential for an activated sludge plant. A diagrammatic plan of such, showing the location of various meters, is given in Fig. 6 in which the flow of sewage from influent to final effluent may be easily traced.

Where it is desirable to know the amount of storm water which is by-passed, such measurements may often be made by a Parshall Flume, as shown in Fig. 6.

It might also be added here, that another function of the meters on the discharge side of the raw sewage pumps is to serve as a means of testing the performance of the pumps in their initial acceptance tests, and then to serve as a means of indicating when operating efficiency drops off due to worn impellers or other cause.

Chemical Measurements

Where chemicals are used either for chemical precipitation or for disinfection, the amounts used should of necessity be definitely and accurately known. Chemicals, for the most part, are added as solutions, with the exception of chlorine which is generally measured as a gas or by weight.

In days gone by, it was customary to add chemicals more or less haphazardly, with little control over concentration of the solution or suspension and perhaps still less control over the amount or dosage. Such is not the case today. Where chemicals are added, for whatever reason, it is essential that the amount added and the concentration be definitely known. More importantly, it is essential that chemicals added shall be in the proper dosage to meet any variation in flow of sewage or sludge being treated.

Proportional dosage is accomplished by "pacing" the chemical feeder from the flow measuring device. These chemical feeders are of many styles and designs and are constructed for specific purposes in many instances. Most, if not all, of these chemical feeders are capable, not only of adding the chemical to the liquid being treated, but also of measuring the amount according to the flow desired, and of recording the amount of chemical actually fed.

Measurement of Solids

One of the important things to know in a sewage plant is the amount of solids removed from the sewage. Of course, it is possible to actually weigh the amount of grit removed; and if there is continuous grit removal, it is possible to have a continuous weighing record by means of such a device as the Conveyoflo meter. (Fig. 7) Grit is most generally handled in the moist or wet condition in which it comes from the grit channels or grit washers; and to know the amount of dry solids removed, it is necessary to determine the amount of moisture in the grit.

The amount of dry solids removed as sewage sludge is very important. If the raw sludge is digested, it is important to know how much residue there is. Thus, measurement of the liquid volume of sludge in and out is essential and the dry solids are actually determined by analyzing properly collected samples of both the raw and the digested sludge. Where the sludge is elutriated or is conditioned and dewatered by vacuum filtration without elutriation, it is also essential to good operation to know how much sludge is actually handled as well as the chemicals which are used, and if the sludge is incinerated, the amount of ash which is left. Liquid volumes of sludge may be measured by Venturi meter or by liquid level gauges, with recording meters, of course. (Fig. 5.) Sludge cake from vacuum filtration, or dried sludge or ash may be measured by a Conveyflo meter which operates in connection with a moving belt. (Fig. 7.)

Gas Measurement

In general, only three gases are measured in a sewage treatment plant,—gas from sluge digestion, air for activated sludges, and chlorine gas for disinfection. Everyone wants to know how much gas is given off by sludge digestion, and this is particularly true where that gas is used for heating buildings or for the operation of sludge gas or dual-fuel engines. Sludge gas may be measured by meters in which the parts rotate in response to the flow of gas, or by orifices, or by gasometers. All three types of measurement devices may be arranged to give indicating or recording and totalizing records if desired, and it is sometimes desirable to know the rate of gas evolution as well as the total amount. For this reason, too, it is well to have gas meters on each sludge digestion tank. Where gas is used for boilers or for the operation of gas engines, it is advisable to have meters on the individual lines to these units.

As is shown in Fig. 6, air measurement in an activated sludge plant is extremely important to the proper operation of the plant. Meters on air lines, not only show the actual input of air to the aeration units, but also indicate when there is a falling off of the air to the tanks—a condition that might be caused by clogging of the diffuser plates.

Chlorine gas is most generally measured by a chlorinator, or by the "Chlorinizer" (Fig. 8) which actually sets the rate of flow of the dry chlorine gas and measures and records the amount of gas actually fed. It is possible by means of controlling equipment to feed the chlorine in any ratio desired in relation to the flow of sewage. Accurate records of this dosage and total amount fed may be obtained through the proper metering recorders. Final checks on the amount of chlorine added to sewage may be had through weighing of the containers full and empty.

Miscellaneous Measurements

In addition to the above information, it is desirable to know how much electricity is used in the plant and it may be desirable to know where that electric power is used. For this purpose, regular type electric meters are used. An operator should also know how much "clean" water is used around his plant, and particularly if that water is purchased from another city department. There are several types of meters available for the measurement of water, depending on the installation, amount of water used, and other factors.

Examples of Meter Installations

Figure 6 is a diagrammatic plan of an activated sludge plant, the various meters used and locations thereof, and is an example of good and complete metering. Perhaps it would be well to describe this layout somewhat in detail.

The two most important Venturi meters are the Master Sewage Meter at A, and the Master Air Meter at B. On these are based the most valuable plant records, but it is apparent that these two meters will not reveal or segregate points or units of poor operating efficiency. This is the duty of additional meters. Operation of the centrifugal pumps is recorded by Venturi meters at C.

Meters located at D show the discharge from each main blower and indicate not only amount of discharge, but by daily record will show any loss in performance. Venturi meters at E can be used to apportion correctly the flow to each of the primary settling tanks.

Sludge from the settling tanks may be removed and measured through Kennison Nozzles at F. The aeration tanks each have three Venturi Meters at G, H, and K. One of these meters measures the influent sewage, the second measures the return sludge, and the third measures the air entering the tank. It is essential to good operation to know how much of each of these materials is entering the aeration tank.

Newly developed gauges, in connection with these Venturi Tubes, are available, not only for indicating and recording rates of flow, but also for showing ratios of sewage and return sludge to incoming sewage. Automatic rate control of any or all of these is possible.

At the two final settling tanks, Venturi Meters at L, with control valves, serve a purpose similar to the Venturi Meters at E, while Venturis at M with control valves make it possible to regulate and record the flow of activated sludge from these tanks to the suction well of the sludge pumps.

As indicated previously, a Parshall Flume, as at N in Fig. 6, is used to measure and record by-passed storm water.

Sewage Testing

In the matter of testing or analyzing sewage to determine the amounts and concentrations of various components or characteristics, most state health departments have established minimum requirements which are desired. Minimum requirements as to the condition of the final effluent are usually stated, and therefore, it is essential that certain tests be made in order to know

whether or not the final effluent meets the standards.

These requirements vary with various influencing factors, such as size of receiving body of water, whether or not the receiving stream is a water supply, and other factors which can not be delineated here. State health departments are, however, usually interested in the same things a good operator should be interested in, namely, the amount of solids (putrescible matter) and oxygen demanding substances removed.

Naturally, to know the efficiency of operation, it is necessary to know what removal is accomplished. This means that tests must be made on both the influent and effluent. And in order that these data may be calculated to quantitive units, it is of course necessary to know how much sewage passed through the plant—hence the need for volume or flow measurements mentioned above.

In addition to these basic tests, other determinations may be made, depending on the size of the plant, type of treatment, and the control of disinfection required.

Tests also may be made of samples from different parts of a plant for better control purposes. For the most part, the tests to be made will be dictated by the size of the plant, its complexity, and the requirements of the state health department as to records and minimum standards.

Records

As in the case of measurements and tests, the records kept are generally dictated by size, complexity, and type of plant, and requirements of the state health department. It should be quite obvious that even in the simplest plant, records should be kept of the amount of sewage flowing through the plant and the amount of material removed from that sewage. A trustworthy axiom for the operator is: "Wherever a measuring device exists and is operated, and wherever samples are collected and analyzed, records should be kept of the data collected."

In most states, the state health department prescribes the minimum number of records to be kept, that is the minimum amount of data to be recorded. Usually these records are long sheets with column headings showing the tests or physical measurements, with horizontal lines being dated with the days of the month. Averages are usually kept by months.

Whole treatises have been written on the design of plant records for different types of plants, and of the importance of these records and how they may best be used to control and improve operation and to keep operating costs down. This article cannot even set forth briefly the main points of those articles. The reader is referred to the indexes of magazines in this field, where numerous such articles will be listed. It is important to remember that keeping records will be of help in operating any plant.

Fig. 8—Chlorinizer gas chlorine feeder 100 to 6000 lb. per 24 hr. capacity.

Summary

In brief summary, it may be pointed out that some of this discussion at first glance may not appear to be applicable to the small sewage plant. On the other hand, it should be emphasized, that in small plants as well as large, accurate measurements and recordings of plant operation are doubly important, especially if only daytime attendants are available.

With competent "overseers," such as good meters and recorders, the plant operator has available ready information on flow rates, distribution, ratio values, pump performance, and so forth. These records are available and valuable for seasonal comparison.

In actual dollars, the amount saved by careful and efficient operation of a small plant may not be big—in a large plant it is vital—but when one computes the savings in percentage of the total operating expenses, the value may be surprisingly large—again indicating the importance of good measurements and records. With this in mind, it may well be said "for every dollar invested in metering, that dollar is returned many times over as savings during the life of the plant." And it is worthy of repetition that "meters, tests and records are important to all sewage works."

Sewage Service Fees Collected by Utility for Municipality

What comes out the water tap must go down the drain. At least, that's what Chattanooga, Tenn., figures. The southern city has contracted with City Water Co., Chattanooga, a subsidiary of American Waterworks Co., to collect sewage service fees, which will be added to the company's water bill.

The fees will back up an issuance of $5 million to $8 million sewer revenue bonds. Sewage disposal improvements built from the proceeds will enable Chattanooga to meet the public health standards of the State Stream Pollution Control Board.

To insure payment of sewage charges, the water company has the right to discontinue water service in the event citizens don't ante up. If nothing comes out the water tap, nothing goes down the drain, Chattanooga figures.

Stream Pollution Abatement Good Tourist Attraction

The Wisconsin state committee on water pollution is critical of stream conditions in the scenic dells area, one of the State's greatest tourist attractions.

The committee made it clear that more attention would be paid to the clean water needs of tourists and vacationists. Water that smells of paper mill wastes and is dangerous from raw sewage is not exactly a good advertisement, the committee agreed.

"The guests of the state are entitled to safe and clean water," said the committee.

Ain't It So!

About the time we begin to feel pretty well satisfied with what we have, the Joneses buy a nice new shiny car.

THE EDITOR'S COMMENTS

Convention Time Approaching

By the time this issue reaches subscribers it will be nearing AWWA's Annual Convention time, May 4-9. The place is Kansas City, Mo., which means a well attended convention—or, always has.

Because of its distant location in Miami, Fla., the attendance at last year's convention created no new record, as was to be expected. At centrally located Kansas City a record attendance is expected. Many will come from the South, Southwest and the Pacific Coast. Members of the stalwart and growing Southwest Section will come to see "a favorite son"—Oklahoma City's Water & Sewage Supt., Morrison Cunningham, take office as AWWA's new vice-president on his way to becoming president in 1953.

At this writing the technical program for the Kansas City Convention has not been released for publication, but we can say that the Program Committee has developed a program which should be considered a "must" for every water works man who can beg, borrow or steal (temporarily) the where-with-all to get to Kansas City. Those who may have just recently found that they can attend the convention can still obtain hotel accommodations by applying to the A.W.W.A. Office, 521 Fifth Ave., New York 17, N.Y. Hotels are conveniently located with respect to the K.C. Auditorium and rates are reasonable.

Nobody ever has to sell a water works man on attending AWWA conventions if he has ever before attended one. Convention attendance grows year by year just as has membership in the Association. Comparing attendance at the 1940 and 1950 conventions shows an increased attendance of 542—a gain of better than 37% over the decade. During the four-year period, 1946-1950, the attendance increased by 490, which was better than a 32% gain. One can only say of the steady increase in such attendance, "there must be a reason." All of this notwithstanding the fact that AWWA conventions are not ballyhooed in advance as so many others are.

To those who may have their first water works convention to attend we wish to tell you that you will find a great spirit of brotherhood and an atmosphere of helpfulness. If you have questions or problems bothering you just let your questions be known and if the fellow you ask doesn't know the answer he will find someone who does. Nine times in ten you will have the answer before the convention is over.

Space will not permit going into the many benefits which accrue to those attending water and sewage conventions. And, about the value of membership in AWWA, we join with D. A. Rochester of the Univ. of Nebraska who once wrote—

"I do not recall that I have ever known a person who has stood high in his business or profession who has not actively affiliated himself with organizations, attended meetings, and read magazines concerned with his affairs. These seem to be the ways in which people keep up to date and alert to the new things which are going on. I should dislike to trust myself or a member of my family to the care of a physician who does not belong to a medical association, who does not read professional journals, nor go to professional meetings."

Who Owns Your "Cash Register?"

Water meters are commonly referred to as the "cash registers" of the water utility business.

It is difficult to contemplate any business in which the customer would purchase, install and maintain the cash-register of the business, but surprisingly enough there still are water departments which do not install, own or maintain the customer's water meters—the "cash registers" in their business of selling water.

Only recently has the City of Milwaukee brought to an end a plumbers' racket of 50 years standing in which the water takers have been forced to employ plumbers to install their meters. The plumber would purchase the meter from the Water Department, which in turn would install the meter and bill the plumber. The plumber would then bill the property owner for meter and installation, but having done none of the work and at the same time having added a racketeering profit to the price of the meter. Even now the customer must purchase his meter but is permitted to buy direct from the Water Department.

New York City is still permitting and fostering this plumbing trade racket by requiring customers to purchase installed meters from an approved plumber. The water taker can not purchase his meter where he may please and make his own installation. Furthermore, if the customer wishes his meter tested he is told by the Water Dept. to take it up with his plumber. Many will hardly believe that such archaic practice still exists in the great metropolis of New York City, but it does.

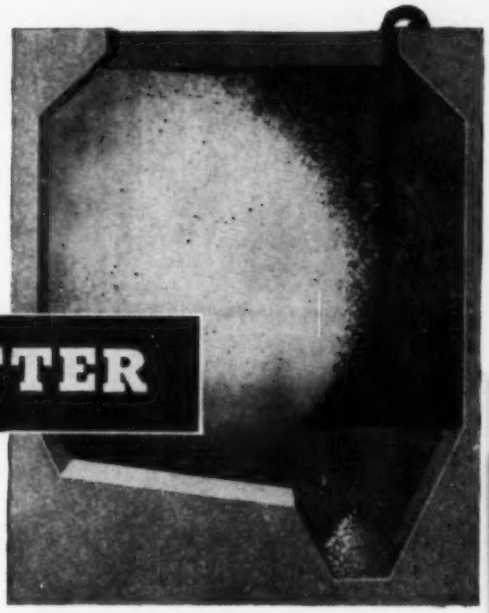
In recent years there have been a number of corrections of such an unrealistic practice which, as far as we are aware, has never existed in any other utility that markets its products through meters.

Various water departments have employed various methods of paying the meter owner for his equity in the meter taken over by the city. The prevailing method is that of paying the customer his equity on something akin to an installment plan of gradual take-over. We do not believe that the customer should be the one to own and maintain the "cash registers" of the water works business.

L. H. Enslow

6
IMPORTANT BASIC FEATURES

Chicago
AER-DEGRITTER



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Chicago Aer-Degritters are operating successfully at Oildale, Calif., Columbus, Ohio, Tomah, Wis., Bellaire, Texas and Sedalia, Mo. Aer-Degritters being installed include Fort St. John, B. C., Warsaw, Ind., Elmira, N. Y., Oklahoma City, Okla., Port Washington, N. Y., Anderson, S. C. Design flows of these plants range from .75 to 160.0 MGD.

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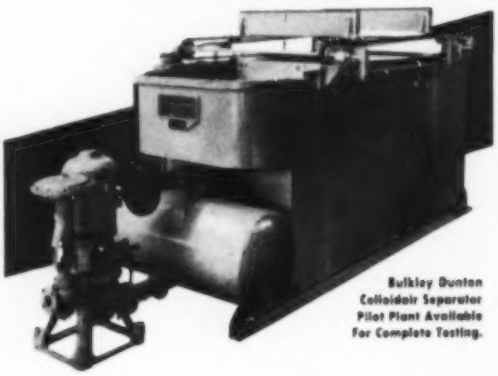

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Meetings Scheduled

Mar. 9-13—College Station, Texas *(Texas A. & M. College)*
TEXAS WATER & SEWAGE WORKS ASSOCIATION. Sec'y, V. M. Ehlers, 501 West 33rd St., Austin, Texas.

Mar. 12-14—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, M. J. Kachorsky, P.O. Box 766, Manville, N. J.

Mar. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSOCIATION (Monthly Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Mar. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND SECTION A.W.W.A. Sec'y, George E. Bogren, 14 Beacon St., Boston, Mass.

Mar. 24-26—Augusta, Ga. *(Bon Air Hotel)*
SOUTHEASTERN SECTION A.W.W.A. Sec'y, T. A. Kolb, State Board of Health, Wade Hampton Building, Columbia, S.C.

Mar. 26-28—Chicago, Ill. *(Hotel LaSalle)*
ILLINOIS SECTION A.W.W.A. Sec'y, J. L. Hart, 122 So. Michigan Ave., Chicago 3, Ill.

Apr. 3-5—Mesa, Arizona *(Maricopa Inn)*
ARIZONA SEWAGE & WATER WORKS ASSOCIATION (and) ARIZONA SECTION A.W.W.A. Sec'y, H. S. Jordan, State Dept. of Health, Phoenix, Ariz.

Apr. 7-9—Fayetteville, Ark. *(University of Arkansas, Eng. Bldg.)*
ARKANSAS WATER & SEWAGE CONFERENCE. Dr. Harrison Hale, Southern State College, Magnolia, Ark.

Apr. 9—North Jay, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Apr. 10-12—Spartanburg, S.C. *(Clemson College)*
SOUTH CAROLINA WATER & SEWAGE WORKS ASSOCIATION. Sec'y, W. T. Linton, Wade Hamilton Bldg., Columbia, S.C.

Apr. 10—Billings, Mont. *(Northern Hotel)*
MONTANA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, H. B. Foote, State Dept. of Health, Helena, Mont.

Apr. 11-12—Billings, Mont. *(Northern Hotel)*
MONTANA SECTION A.W.W.A. Sec'y, A. W. Clarkson, State Board of Health, Helena, Mont.

Apr. 16-18—Syracuse, N.Y. *(Hotel Syracuse)*
NEW YORK SECTION A.W.W.A. (Spring Meeting). Sec'y, R. K. Blanchard, 50 West 50th St., New York, N.Y.

Apr. 17—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Jos. C. Knox, 204 Tremont Building, Boston, Mass.

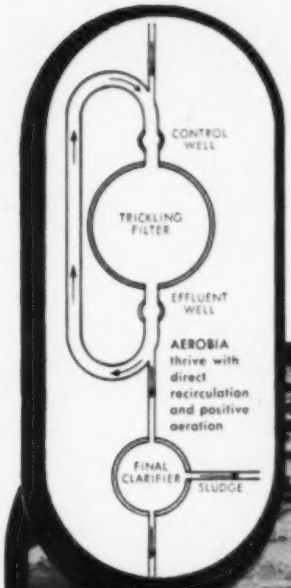
Apr. 17-18—Washington, D.C. *(Wardman Park Hotel)*
MARYLAND-DELAWARE WATER & SEWERAGE ASSOCIATION. Sec'y, W. M. Bingley, 2411 No. Charles St., Baltimore, Md.

Apr. 17-18—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION A.W.W.A. Sec'y, E. Bruce Meier, University of Nebraska, Lincoln, Neb.

Apr. 24-26—Spokane, Wash. *(Davenport Hotel)*
PACIFIC NORTHWEST SECTION A.W.W.A. Sec'y, O. P. Newman, Boise Water Corp, Boise, Idaho.

May 3—Kansas City, Kansas *(Town House)*
KANSAS SECTION A.W.W.A. Sec'y, H. W. Badley, 640 Highland St., Salina, Kansas.

(Continued on page 78A)



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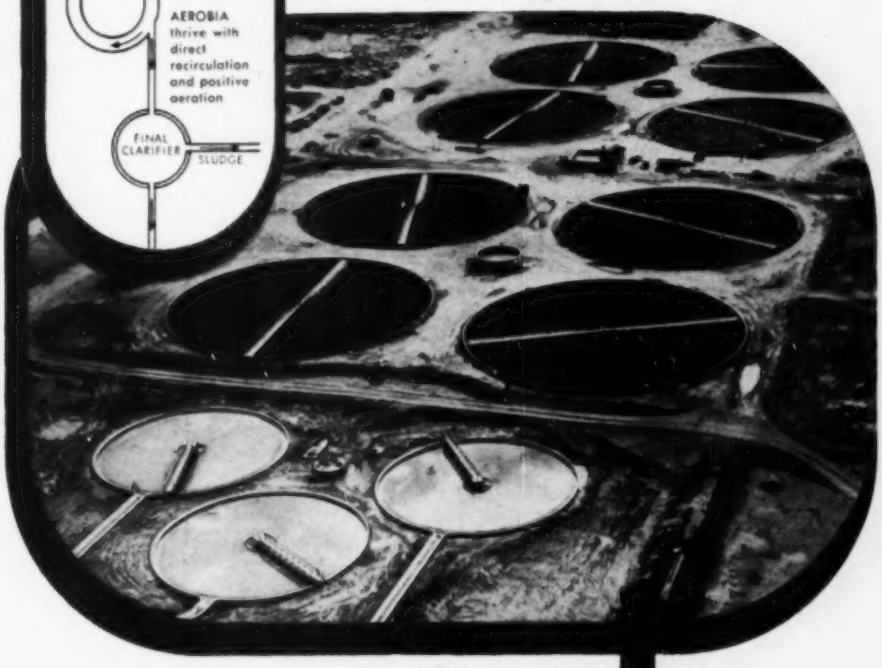

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Meetings Scheduled

(Continued from page 76A)

May 4-9—Kansas City, Mo. *(Municipal Auditorium)*
AMERICAN WATER WORKS ASSOCIATION (Annual Convention). Exec.-Sec'y, Harry E. Jordan, 521 Fifth Avenue, New York 17, N.Y.
(Accommodations in 14 hotels. Reservations through A.W.W.A. office.)

May 7-9—Lafayette, Ind. *(Purdue Memorial Union)*
7TH PURDUE INDUSTRIAL WASTE CONFERENCE. Director, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 12-13—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSN. Sec'y, G. R. Talcott, 815 E. Franklin St., Richmond 19, Va.

May 21-23—Toledo, Ohio *(Commodore Perry Hotel)*
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONFERENCE. Sec'y, J. E. Richards, 301 Ohio Depts. Bldg., Columbus 15, Ohio.

May 26-28—Montreal, Canada *(Hotel Mt. Royal)*
CANADIAN SECTION A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Dept. of Health, Parliament Building, Toronto, Ont.

June 6—Auburn, Ala. *(Pitts Hotel)*
ALABAMA WATER & SEWAGE ASSOCIATION. Sec'y, Alex O. Taylor, Box 69, Alabama Polytechnic Institute, Auburn, Ala.

June 11—Houlton, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

June 18-20—Erie, Pa. *(Lawrence Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

Aug. 13—Machias, Maine.
MAINE WATER UTILITIES ASSOCIATION. Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Aug. 25-27—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. Rupert Kountz, Pennsylvania State College, State College, Pa.

Aug. 27-29—State College, Pa. *(Nittany Lion Inn)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 3-5—Upper Saranac, N. Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th St., New York, N.Y.

Sept. 8-10—Groton, Conn. *(Hotel Griswold)*
NEW ENGLAND WATER WORKS ASSOCIATION (Annual Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 8-13—Chicago, Ill. *(Hotels to be announced)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Centennial Celebration). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

Sept. 9-11—Grinnell, Iowa *(Grinnell College)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, Box 310, Webster City, Iowa.

Sept. 10-12—Sioux Falls, S.D.
MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Dept., St. Paul, Minn.

Sept. 15-17—Knoxville, Tenn. *(Andrew Johnson Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, R. P. Farrell, Dept. of Public Health, 420—6th Ave., Nashville, Tenn.

(Continued on page 82A)

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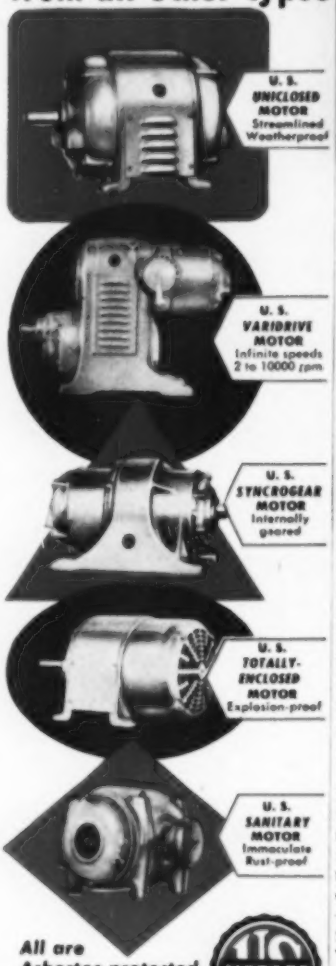
U. S. UNICLOSED MOTOR Streamlined Weatherproof
U. S. VARIDRIVE MOTOR Infinite speeds 2 to 10000 rpm
U. S. SYNCROGEAR MOTOR Internally geared
U. S. TOTALLY-ENCLOSED MOTOR Explosion-proof
U. S. SANITARY MOTOR Immaculate Rust-proof

All are Asbestos-protected

Asbestos cannot carbonize. Protects windings forever. Adds years of motor life.

US MOTORS

MAIL COUPON for Condensed Catalog

WS-3

U. S. Electrical Motors, Inc.
300 E. Slauson Ave., Los Angeles 54, Calif.
or Milford, Conn.

Send Condensed Catalog featuring all U. S. Motors.

Name_____

Company_____

Address_____

City Zone State

Here and There with Doc Symons

H.T.M.A.—And I hope that you are planning and looking forward to attending the AWWA Convention in Kansas City. Fellows like Mel Hatcher, who directs the Water Dept. in K.C., and Tom Veatch, a Past Prexy of AWWA, who directs a firm of Cons. Engrs. in the same metropolis, and E. L. (Blueprint Now) Filby, who works with Tom, and a host of other nice people, will all be looking for you around May 5-9,—and so shall I!

* * *

A few weeks ago, I was in the office of Metcalf & Eddy, Cons. Engrs., Boston, and I had a few minutes with "Stu" Coburn, M & E's Chief Chemist (and industrial waste expert). "Stu" said, "Doc, my wife still looks for your column, first thing when *Water & Sewage Works* arrives, and we're glad you're going to continue to write it, but I wish you'd get more names in it. I feel like I'm meeting those people when I read about them in your column and I'd like to meet more."

Of course, that comment about Mrs. "Stu" makes her one of my favorite persons, but his other comment has worried me a little. Was I failing my readers? I tried to explain to "Stu" that each name had to be connected with a story in some way—and I have to depend on my readers to supply those stories—"Stu" promised me a story—it hasn't come yet.

When I came home, I did some more thinking on the subject.—How many names have I been getting into the column?—So I counted up last year's output. In 12 columns published in 1951 (each column averaging about a page and a third), I wrote 143 items. Twenty-four of these items were opening or closing paragraphs which leave 119 "stories" (three were travelogs). In these 119 items I found 258 names, not including a half dozen or so persons

(*Continued on page* 84A)

CUT COSTS ON UNDERGROUND PIPING JOBS

...with a GREENLEE PIPE PUSHER

Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors... eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.

No. 700 GREENLEE PUSHER For 3, 4 to 4-inch pipe. Six speeds—5,000 to 40,000 lbs. pushing pressure.

No. 705 GREENLEE PUSHER For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds—25,000 to 150,000 lbs. pushing pressure.

POWER PUMP For both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

GREENLEE

Get facts on timesaving Greenlee tools now. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 2243 Columbia Avenue, Rockford, Illinois, U. S. A.

ALWAYS THE BEST—FOR DALLAS

Sludge Collectors
Sludge Elevators
Grit Washers
Grit Collectors
Scum Removers
Spiral Conveyors
Screenings Grinders
Garbage Grinders
FLOCTROLS
Rapid Mixers
Bucket Elevators
Chains, Sprockets, Bearings

They do things up in a big way down in Texas, and Dallas is no exception. When it came to specifying the most modern equipment for treating sewage, Jeffrey received the call.

Screens, Grinders, and Grit Collectors . . . combined into a coordinated system to provide an efficient plant for this large and progressive city in the southwest.

We could name you hundreds of cities, as big as and often larger than Dallas, in which Jeffrey sewage and water treatment equipment is performing in a most satisfactory manner. Specify Jeffrey if you want the best . . . the most modern.

CATALOG NO. 833

THE JEFFREY MANUFACTURING COMPANY Established 1877

996 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

Baltimore 2 · Beckley, W. Va. · Birmingham 3 · Boston 16 · Buffalo 2 · Chicago 1 · Cincinnati 2 · Cleveland 15 · Denver 2 · Detroit 13 · Forty Fort, Pa. · Harlan, Ky. · Houston 2 · Jacksonville 2 · Milwaukee 2 · New York 7 · Philadelphia 3 · Pittsburgh 22 · St. Louis 1 · Salt Lake City 1

Jeffrey Mfg. Co. Ltd., Montreal, Canada
British Jeffrey-Diamond Ltd., Wakefield, England
Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
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Ferri-Floc a superior coagulant offers many advantages — Here's what you can expect with Ferri-Floc. —

1. Rapid Floc Formation?
2. PH correction?
3. Taste and odor control?
4. Color removal?
5. Softening?
6. Ease of operation?
7. Bacterial removal?
8. Manganese and Silical removal?
9. Turbidity removal?
10. Economy?

FREE — Let us send you without cost, our new booklet on economical and efficient coagulation. Just send a card or letter to Tennessee Corporation, Grant Building, Atlanta, Georgia or Lockland, Ohio.

TENNESSEE TC **CORPORATION**
Atlanta, Georgia — Lockland, Ohio

Meetings Scheduled

(Continued from page 78A)

Sept. 15—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 272 City & County Bldg., Denver, Colo.

Sept. 16-17—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, Box 600, Denver, Colo.

Sept. 18-19—Cincinnati, Ohio.
OHIO SECTION A.W.W.A. Sec'y, F. P. Fischer, 812 Perry Payne Bldg., Cleveland 13, Ohio.

Sept. 21-23—Jefferson City, Mo.
MISSOURI SECTION A.W.W.A. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 23-25—Madison, Wisc. *(Hotel Loraine)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wisc.

Sept. 24-26—Battle Creek, Mich. *(Post Tavern)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

Oct. 6-9—New York, N.Y. *(Statler Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS (Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill. (and)

NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N.Y.

Oct. 8—Bethel, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Oct. 12-15—Tulsa, Okla. *(Mayo Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 14-17—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 20-24—Cleveland, Ohio
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Oct. 23-25—Atlantic City, N.J. *(Hotel Madison)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 23-25—Mason City, Iowa *(Hanford Hotel)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 28-31—Pasadena, Calif. *(Huntington Hotel)*
CALIFORNIA SECTION A.W.W.A. Acting Sec'y, Lee Streicher, Metropolitan Water District, 545 Cloverleaf Way, Monrovia, Calif.

Oct. 29-31—Washington, D.C. *(Wardman Park Hotel)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl L. Lauter, 6955 33rd St., Washington, D.C.

Nov. 5-7—Old Point Comfort, Va. *(Chamberlin Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, Regional Engr., 708 State Office Bldg., Richmond, Va.

Nov. 10-12—Hendersonville, N.C. *(Hotel Skyland)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 16-19—Pensacola, Fla. *(Hotel San Carlos)*
Joint Meeting
FLORIDA SECTION A.W.W.A., Sec'y, M. R. Boyce, 504 Pennsylvania Ave., Clearwater, Fla.

ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, C. W. White, State Board of Health, 519 Dexter Ave., Montgomery 4, Ala.

Dec. 10—Winthrop, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

IN HAMILTON, ONTARIO—The problem was to install seven miles of 48" line, fast, to meet the terrific demands of the city's rapidly expanding industrial and residential areas. A $1,900,000 job, including the filtration plant. With confidence, Hamilton engineers specified a Dresser-Coupled steel line.

A DRESSER-COUPLED STEEL LINE delivers water cheaper

Be Sure you get the best line at the best price. Put steel pipe and Dresser Couplings in your specifications.

The cheapest way to pipe water to where it turns into revenue is with a Dresser-Coupled steel line—the line that cuts *installation* costs, *leakage* losses and *maintenance* expense.

As in the case of this Hamilton line, existing pipe networks often seriously complicate the installation of new mains. Lighter, easier-handled steel pipe joined with Dresser Couplings—simpler to make up, even in cramped ditches—provides the swiftest, most practical way of getting under or around underground obstacles. The line is completed quicker—starts paying its way sooner.

Leakage losses are eliminated. *Controlled gasket pressure*, provided by the bolting up process in a Dresser Coupling, is your assurance of the correct *sealing* pressure all around the joint. Resilient Dresser gaskets absorb stresses from vibration, contraction and expansion, yet keep the joint "flexible-tight".

Maintenance is cut to the bone, too. Dresser Couplings last for life, and the absence of heat in joining prevents damage to glass-smooth pipe linings. High carrying capacity is sustained.

Experience all over the world proves that a Dresser-Coupled steel line gives you the ultimate in performance and economy. See your Dresser Sales Engineer or write our Bradford Office for detailed information.

DRESSER

"FLEXIBLE-TIGHT"

COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto, Ont.

(Continued from page 80A)

not connected with the water or sewage field. A few persons, like the Brass Hats of AWWA, NEWWA, FSIWA and Society of Council Bluffers were mentioned more than once. So-o-o-o, I actually introduced my readers to more than 200 persons last year.

The more I thought about Stu's comment, the more I thought, maybe I was doing O.K. for there are other persons who have said to me, "Why don't you do more Small World items,—more Karicatures by Kit,—more poems by Helen Ball,—more pictures,—more letters from readers, —more Hats Off items,—more editorializing,—more travelogs,—more Water Works Romances,—more etc., etc., etc.

You know, if that show business axiom is correct—"Always leave them wanting more"—then I guess I'm doing alright.—Or am I? Anyway, here are a few answers to some of those requests.

* * *

You will recall, how in my Sept. column, I placed Art (Waukesha) Kuranz in Kenosha, and how I made amends in November and made comment in January on Art's forgiveness, etc., well, read this—

"Dear Doc—It is perhaps a natural fault when thinking of progressive, able, and upstanding men, to wish to associate them with a progressive and upstanding community.

"Your readers in Kenosha were fully aware of the error in the case of Art Kuranz, but since we know nothing but the very best about him, we felt that a correction was not necessary. Certainly, we see no reason for you to be apologetic about it.

"As for Tom Hay, he's a fine fellow, and we don't mind accepting him as a Kenoshan. To prevent further complications, however, here is the record as we know it:

"Jim Myers—a native Kenoshan; now at Bryn Mawr, a suburb of Philadelphia.

"Ted Rudgal—formerly of Kenosha; now at Gary, Ind., a suburb of Chicago.

"Art Kuranz—at Waukesha, a suburb of Milwaukee.

"Tom Hay—at Racine, a suburb of Kenosha.

"For recognizing that nothing but the best is good enough for these men, and that they merit being identified as Kenoshans, we confer upon you our highest accolade. You are now an honorary citizen of Kenosha.—Cordially, Frank I. Vilen, Supt. Sew. Treat., Kenosha, Wis."

Thanks for the honor, Frank; now I have only to hear from Jim Myers, Ted Rudgal, and Tom Hay to make this complete.

* * *

A. E. (Bert) Berry, current President of AWWA, and Big Wheel in the Ancient and Royal Order of Sewer Rats of Ontario, sent me this poem by Helen (Mrs. Ollie) Ball, of Toronto. (Ollie is one of Berry's sanitary engineers) The poem was presented at the annual Christmas dinner of the AROSRO.

The Spoilers

Since marrying an engineer,
(The Sanitary kind)
I've learned enough that's bad or queer
To set my sullied mind
To dreaming of a better land—
A strictly PURE creation—
Where not a soul will understand
That word "Contamination"

And everybody will partake
Of milk, fresh-a-la-cow,
Or water from the nearest lake
Unchlorinated. WOW! ! !
No sani-man will spoil the thrill
Of the picnicker's ablution
In some uncharted road-side rill
By mentioning "pollution."

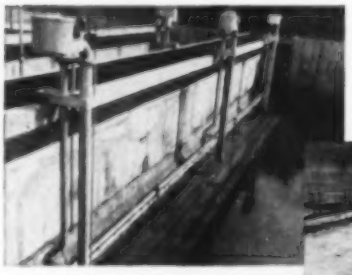
We're told that, minus engineers,
(These sanitary men)
The likely total of our years
Would not be three-score-ten.
But WHAT, I ask you, WHAT, my friends,
WHAT have these meddlers done
To compensate, to make amends
For spoiling all our fun?

—By Helen Ball.

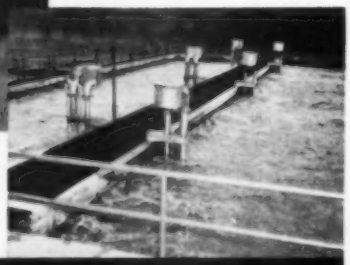
* * *

SMALL WORLD No. 16—On New Year's Day, my girl, Va., and I went calling on some friends and were introduced to another guest at the

(Continued on page 86A)



DIFFUSAIR installation at Kirkwood, Mo. Impingement nozzles and bowls are on headers at lower left side of tank.



DIFFUSAIR at Kirkwood, Mo. in operation showing effective "spiral flow" agitation and aeration of tank liquor.

impingement aerator **DIFFUSAIR**

FOR SEWAGE WASTE AND WATER TREATMENT PRE-AERATION . . . ACTIVATED SLUDGE . . . CARBONATION

The Impingement Aerator is a unit developed to accomplish more effectively and economically the diffusion of air as small bubbles to agitate and oxygenate aeration tank liquors.

The principle involved is the combining of a low velocity jet of tank liquor and large air bubbles within an open bowl-like impinger. The cavitation effect thus produced divides the air into smaller bubbles than those diffused from a No. 30 permeability porous tube. The amount and pressure of the impingement water is very low when compared with the progressive back pressuring of the blower that persists when other types of air diffusers are employed.

The impingement liquor is derived directly from the aeration tank mixed liquor, and is lifted with a simple air-lift unit from which 1/3 of the fine air is re-entrained and utilized for oxygenation.

The air is released along headers through 3/16 inch orifices in the impinger units and no air clogging is possible. No filtering of the compressed air supply is required since there are no fine diffusion pores to become clogged.

Write for Bulletin 17531

PROQUIP PROCESS EQUIPMENT | WALKER PROCESS EQUIPMENT INC.
FACTORY · ENGINEERING OFFICES · LABORATORIES
AURORA, ILLINOIS

FIELD TEST REPORT

Another Taste and Odor Problem Solved By Our Aqua Nuchar.

PROBLEM: Odor build-up in water in the settling basin. At a water plant using Lake Michigan water, a threshold odor survey indicated that the raw water coming into the filter plant had a threshold odor number of 2.6. After it had passed the settling basin the odor number had increased to 10. Although the odors in the raw water would not ordinarily be considered obnoxious, the build-up in odors within the settling basin made the water unpalatable.

TREATMENT: Approximately 5ppm AQUA NUCHAR was applied to the water entering the mixing basin for about 8 hours, during which a threshold odor survey showed that the intensity of the odor was not increased at the settling basin and remained the same (threshold number 2.6) throughout the plant.

The AQUA NUCHAR Activated Carbon application was discontinued after 8 hours, and subsequent examinations of the water showed that odors again started to build up after passing through the settling basin. Therefore, it was concluded that more carbon would be required to completely stabilize the sludge, so AQUA NUCHAR was again fed at the same point.

This problem illustrates the necessity for running threshold odor surveys of the entire plant, thus safeguarding against conditions within the plant which may have an adverse effect on the quality of the treated water.

This type of service is offered, without cost or obligation, to any water treatment plants facing odor problems. For assistance of this type contact any of the offices listed below.

industrial CHEMICAL SALES

division west virginia pulp and paper company

NEW YORK CENTRAL BLDG.
230 PARK AVENUE
NEW YORK 17, N. Y.

LINCOLN-LIBERTY BUILDING
BROAD AND CHESTNUT STREETS
PHILADELPHIA 7, PA.

2775 EAST 132ND STREET
AT SHAKER SQUARE
CLEVELAND 20, OHIO

PURE OIL BLDG.
35 E. WACKER DRIVE
CHICAGO 1, ILL.

OTHER PRODUCTS: Snow Top Precipitated Calcium Carbonate—Nuchar Activated Carbon—Ligro Crude Tall Oil —Tallene Tall Oil Pitch—Indusoil Distilled Tall Oil—Tallex Abietic Acid—Polycel Cellulose Fibers—Indulin (Lignin)

(Continued from page 84A)

party; a Mrs. M. Hutchinson, who, to carry on a conversation asked me what I did—What would you have answered?—When I tried to explain that I worked (??) in the field of water and sewage treatment, she asked, "Do you know Clark Keith?" "Of course, I know Clark Keith of Windsor, Ont. as who doesn't who has ever been to a Canadian Sect. or to an AWWA Meeting," I said, as I launched into a complimentary commentary. When Mrs. Hutchinson got a word in, it was to tell me that Clark is her brother-in-law, and that he had just had a steam generating power plant named for him in Windsor, where he is Gen. Mgr. of the Utilities Commision.

A quotation from one newspaper which she sent, is graphic and to the point—"J. Clark Keith faced his finest hour yesterday with a humble approach. He is a little man who reached up to close the switch. The second largest steam power plant in Canada—his namesake—went into production."

Not only did they name the plant after him, but they gave him some fancy luggage and a shotgun.—Couldn't happen to a nicer guy!—I go to a cocktail party here in Larchmont and learn about Clark Keith in Windsor, Ont.—Small World!

* * *

Speaking of names—you have all heard Shakespeare's "What's in a name?"—I was having dinner one night with the "Rollie" Leveques and the "Lindy" Harpers (all of the Omega Clan), and we got on the subject of names—

"Rollie" turns out to be Rolland Patrick Joseph Francis. "Nellie" (Leveque) is really Ellen spelled backwards. "Lindy" stands for Lyndus, probably the only one you have ever heard of, and the E. in L. E. Harper is for (Where's) Elmer. "Benny," who is Mrs. Harper, is a nickname for "Benzine," which itself is a nickname for "Izene" her real name.—Me—I was named George after a bartender and Edgar, after an uncle who worked in a bank—and I don't have much to do with either—bars or banks, that is. Mother wanted to name me George Julian. Just think, if she had, I would have had the same initials as George J. Schroepfer, Prof. of San. Engr. at Univ. of Minn.—How about you?—and your name?

* * *

And a picture for those who want one—This one was taken by that "Fella with the camera"—LHE—who snapped it at Provincetown, Mass. on Cape Cod, during the boat cruise from Boston held for the NEWWA last September. It shows some Portugese fisherman mending nets.

It's kinda nice in mid-winter to think about such pleasant things as that trip: The soft breeze, the easy swell, the historic landmarks, "Bill" Rockwell flying over the boat, the Boston Harbor at night, the ocean by moonlight, delicious food, and the many, many good companions. Come another day, and I'm going to give you some of my impressions of that trip.

* * *

Hats Off To—Morrison Cunningham, who will undoubtedly be Vice President-Elect of the AWWA by the time you read this.—M. B. is head of the Water Dept. of Okla-

(Continued on page 88A)

THE
SMITH
Gate Valve
MANUAL,
ELECTRIC OR
CYLINDER OPERATED

The unique side wedging action employed in the Smith Gate Valve positively prevents premature lateral expansion of the discs and consequent binding and scoring of the seats while the valve is being operated.

28

THE A.P. SMITH MFG. CO.
EAST ORANGE, NEW JERSEY

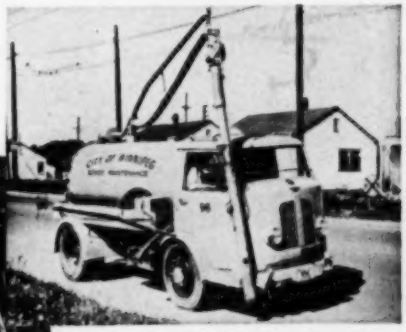
Catch Basin Cleaning Easy and Economical!

This Karrier Catch Basin Cleaner is used by Sanitary Engineering Company, N. Falmouth, Massachusetts for contract cesspool cleaning.

Any municipality that has sewer maintenance problems will agree that the Karrier Catch Basin Cleaner is the answer to their problem for these reasons:

1. **Short wheel base for maneuverability; small turning circle.**
2. **Quiet and slow-running vacuum pump.**
3. **Hydraulic ram separates solids from dirty water thus increasing the effective capacity of the storage tank.**
4. **Subdivided tank with compartments for water and sludge.**
5. **Counterbalanced suction pipe swings to either side or to rear of vehicle.**
6. **Dirty water can be returned to sewer or used for flushing the next catch basin.**
7. **Hydraulic ram discharges load from door at the end of the tank when storage space is filled.**

Another enthusiastic user of Karrier equipment for sewer maintenance is the City of Vancouver.



Top: For sewer maintenance the City of Winnipeg uses this equipment.

Left: City of Toronto is one of more than 750 municipalities using the Karrier Catch Basin Cleaner.

KARRIER

Catch Basin Cleaner vacuums the dirt out

FOR FULL DETAILS WRITE TO:

ROOTES MOTORS INC.

27-11 Bridge Plaza North, Long Island City 1, New York (STillwell 6-2305)

INCORPORATING OVER 30 YEARS OF MECHANICAL CATCH BASIN EXPERIENCE.

(Continued from page 86A)

homa, City, Okla. Unfortunately, my only knowledge of those parts is from having seen that great musical play, Oklahoma, when it opened a long time ago. Well, if I can't get down to that country, I know I'll be seeing M. B. in various places Here & There in the next two years.—Saw him at the Directors Meeting in New York in January, of course.

* * *

It was at the annual lunch of the N.Y. Sect. (AWWA) given in honor of the visiting AWWA Directors, where "Gerry" Arnold, that San Diego boy, now of Washington, D.C. and head of the Water and Sew. Res. Div. of N.P.A., gave a graphic outline of what's what in the matter of Controlled Materials, and how to get them.

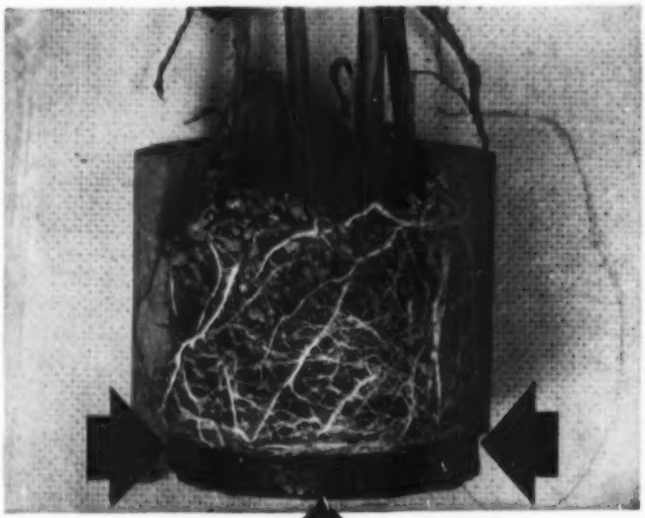
"Gerry" has a great sense of humor—Told about how the Gettysburg Address and the Sermon on the Mount required less than 300 words, but one of those government orders required 27,000 words to reduce the price of cabbage by five cents.

You fellows in this "game" can be mighty glad that "Gerry" is in Washington to take the "BAFFLE-GAB" out of those regulations that concern you. After hearing him talk in St. Paul at the Federation meeting, and again in New York in January, I think someone had superior guidance in picking him for the job. Right now, I'm going to nominate him for Water & Sewage Works Man of the Year for 1952.—I wouldn't be surprised to see him become AWWA Prexy some day.

* * *

Let's see now—I had planned a couple of good items on "Sherm" Chase and I really hoped to start my new feature which will be a glossary of Banquet French, but I've run out of space for this month, so all I can do is to say—"Don't forget the Federation 25th Anniversary Meeting in New York, Oct. 5-9."

V.T.Y.—Doc.



PORTRAIT OF ROOT RESISTANCE ... with ATLAS JC-60 Sewer Joints

Words could not tell a better story about root resistance than the above photograph. It is proof that roots cannot penetrate an ATLAS JC-60 joint. It is proof also that your investment will not be lost to this most common form of sewer line destruction.

JC-60 is a plastic base sewer jointing compound that resists roots BOTH ways: *Hardness* prevents penetration into the compound; *adhesion* prevents roots from entering between the jointing compound and the pipe. No other compound provides both characteristics to this degree.

By every standard, JC-60 excels. It is not affected by thermal shock . . . does not ignite . . . does not deteriorate when overheated. JC-60 has excellent tensile strength, outstanding adhesion, and good flexibility.

Send for Bulletin M20-2

OTHER ATLAS PIPE JOINTING MATERIALS
For Sewers: GK,® Slipjoint GK,® Atlastic 77. For Cast Iron Water Pipe: Tagul-MINERALEAD,® Hydrorings
ATLAS JOINTING COMPOUNDS ...a permanent bond

ATLAS MINERAL — MERTZTOWN, PENNSYLVANIA — HOUSTON 1, TEXAS

Water Board All But Fired For Raising Rates

Members of the Kent County Water Authority of Rhode Island were actually voted out of office by the R. I. House of Representatives for having raised water rates too high. A special bill was introduced in the R. I. House which called for ousting of the five members of the Water Authority of Kent County as the result of a petition signed by 1500 water users. The bill was passed by the House but when the ouster reached the Senate it was tabled and referred to committee. The astounding thing about this action by the legislative body of Rhode Island was that the members of the Kent County Water Authority were given no opportunity at any form of hearing to defend their action in raising water rates.

Since the hike in rates amounted to a reported 300%, it sounds as though the basis for the original rates established to finance the Authority was badly in error. However, the method of handling the unfortunate situation sounds as though the R. I. House has its own "Iron Curtain."

Water Treatment—For Industrial and Other Uses

"Water Treatment—For Industrial and Other Uses," by Eskel Nordell, is a comprehensive reference book of

(Continued on page 90A)

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. P. O. BOX 14
MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—
Nation Wide Service—33 Years Experience

KEEP THE SAFETY FACTOR IN
YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for three years, repairs guaranteed for ten years, provided the tank is painted every three years by Dixie Tank and Bridge Company, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

Dixie's Nation Wide Service Satisfies

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THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

"AT YOUR SERVICE" IN
KANSAS CITY

Just one block from the Municipal Auditorium — Convenient to business, shopping and theatrical districts . . . Tastefully Decorated Guest Rooms . . . Banquet Rooms . . . Club Rooms . . . Sample Rooms . . . Hotel Coffee Shop . . . Bar . . . Cocktail Lounge . . . Parking Facilities.

400 OUTSIDE ROOMS

RATES FROM $3.50 all with baths

THE HOTEL Commonwealth

BROADWAY AT 12TH
KANSAS CITY, MISSOURI

It's New!

- it's different
- it's an "all-use" vinyl primer
- it virtually eliminates surface preparation
- it brushes easily — sprays beautifully
- it dries hard in minutes
- it provides excellent adhesion
- it goes under any type finish

it's TYGORUST

use it on wet or dry rusted steel, on wood, on concrete, on previously painted surfaces.

U. S. STONEWARE
Akron 9, Ohio

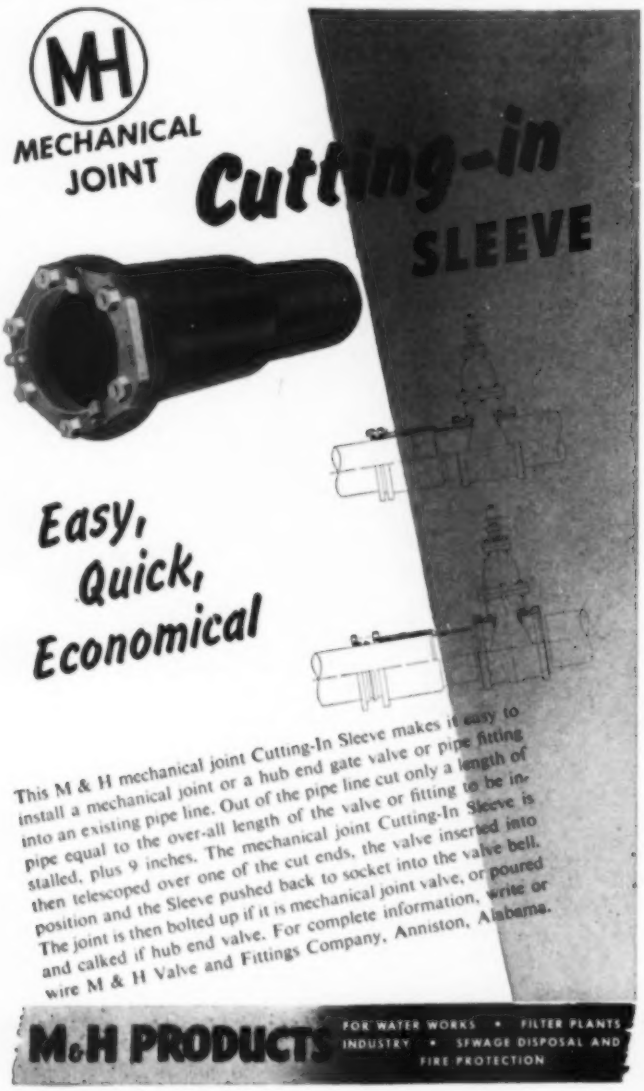
WRITE RIGHT NOW FOR DETAILS!

(Continued from page 88A)

525 pages dealing with the conditioning of water for industrial and domestic applications. A chemist by training, Mr. Nordell has spent over 32 years in the water treatment field. His experience covers the chemical and process industries, and he has long served as Administrator, Analytical Laboratories, Research and Pilot Plant Division, The Permutit Company.

The author has clearly organized and presented his material to emphasize basic principles involved. His solutions to specific problems will be of considerable value to executives, engineers, chemists, and operating personnel. The 18 chapters of the book include discussions of water characteristics and requirements, chemical feeding equipment, aeration and deaeration, clarification processes, and processes for the removal of iron and manganese. The last six chapters describe principles of operation involved in water-softening processes: zeolite, hydrogen cation-exchanger, demineralization and distillation, cold and hot lime-soda, and silica removal.

"Water Treatment—For Industrial and Other Uses" is published by Reinhold Publishing Corp., New York, N. Y. The price is $10.00 per copy.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MECHANICAL JOINT
Cutting-in SLEEVE
Easy, Quick, Economical
This M & H mechanical joint Cutting-In Sleeve makes it easy to install a mechanical joint or a hub end gate valve or pipe fitting into an existing pipe line. Out of the pipe line cut only a length of pipe equal to the over-all length of the valve or fitting to be installed, plus 9 inches. The mechanical joint Cutting-In Sleeve is then telescoped over one of the cut ends, the valve inserted into position and the Sleeve pushed back to socket into the valve bell. The joint is then bolted up if it is mechanical joint valve, or poured and calked if hub end valve. For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS
INDUSTRY • SEWAGE DISPOSAL AND
FIRE PROTECTION

Lucky Crystal Falls Gets Gift of Water Tank

Crystal Falls, Michigan (pop. 2302), felt the need for an elevated water tank but found the water works funds inadequate. Hearing that the Parker Pen Co. of Janesville, Wis., had a 50,000 gal. tank which was not in use the Crystal Falls officials managed to scrape up $750 which was offered the Parker folks for their unused tank. After listening to the story the Parker people, feeling the Christmas spirit and wishing to play Santa Claus to its neighbor town, wired the Crystal Falls Water Board "The tank is yours for nothing. Come on down and take it away."

The same tank new would have cost Crystal Falls $20,000—nice Christmas gift.

Ed. Note: Another reason why I've always liked Parker Fountain Pens.

Women Voters vs. Water & Sewage Authority

"Costly and undemocratic" are terms applied by the Allegheny County League of Women Voters to plans of the City of Pittsburgh administration to create a Water Authority and a Sewage Disposal Authority, according to press reports.

A nine-man civic committee, beginning its study in February 1951, was told by the mayor that its findings would "be a guide to us in making some final and binding decisions that may involve the expenditure of more than $100,000,000 in public funds and that will fix our course of action for two or more generations." He asked that the committee study the municipal authority possibility in view of the city's creaking water system, cost of improvements, and their impact on the city's borrowing capacity.

In September, the press reported "The general presumption is that Mayor Lawrence favors an authority and that his Citizens' Committee will come up with a recommendation to that effect. Two days later the League of Women Voters lashed the authority plan as "a dangerous infringement upon the sovereign rights of the people."

In a recent statement, Mrs. R. Templeton Smith, League president, said "We have been suspicious for a long time that is what they are after. An authority is an undemocratic kind of thing and water is too vital to be shoved where the people can't control

the agency responsible for its administration."

Repair of the city's water system is estimated to cost about $30 million; modernization of the filtration plant $15 million; improvements to pumping stations $5 million; and for water mains and reservoir repairs another $10 million. City income from water is not applied to improvements, but goes into general funds. The League of Women Voters is incensed at this practice, claiming that the "vast majority of other cities put their water rents into a separate fund."

The League endeavored to get a bill through the State Legislature in 1951 forcing the city to use its water rent surpluses to improve the system. The mayor opposed the measure, warning that it would cut $2.5 million from the city treasury.

Excerpts from Purdue's Sanitary Engineering News*

Some stars are so dense that a single cubic inch of their matter would weigh many of our tons.

Though the average man drinks less than half a gallon of liquid in the course of a day, the daily per capita use of water for both domestic and industrial purposes in the United States is over a thousand gallons.

The Indiana Dept. of Health has published the revised "Construction Cost and Financing Data, Municipal Sewage Works in Indiana."

Water is used in the new electric weld mill of the National Tube Co., McKeesport Pa., to stretch heavy steel tubes as much as one-half inch in diameter.

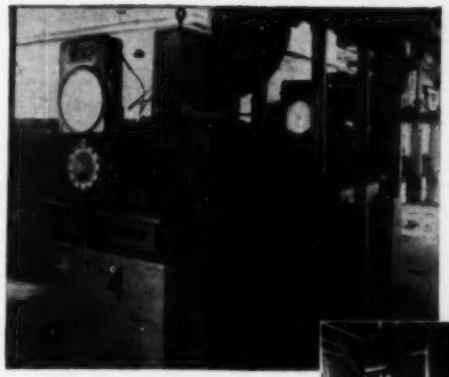
The North Dakota Agricultural College has reported that cobalt has been shown to produce a speed-up in the fattening of hogs, sheep and cattle. Is it needed in water?

Some people don't have much to say, but you have to listen a long time to find it out.

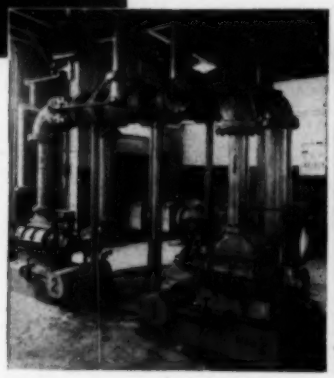
House Bill 127 calling for the Certification of water and sewage works operators should insure better civilian defense if it is passed by the present Indiana legislature.

The Ohio River Valley Water Sanitation Commission has instigated research at the Kettering Laboratory of Applied Physiology at

*Edited by Prof. Don E. Bloodgood.



Part of an installation of nine R-C Meters in a large plant, some of which date back 10 years or more. Capacities range from 3,000 cfh to 130,000 cfh.



YOU CAN ALWAYS

trust

R-C METERS

Continued repeat orders for R-C Positive Displacement Meters indicate the complete confidence of sewage treatment plant operators in the unvarying reliability of these units. Many have been installed so long that the original dates have been forgotten—yet they continue to measure as dependably as the day they were first put into service. That is because:

1. Accuracy is not affected by variations in specific gravity, rate of flow, pulsation, moisture, impurities or uncontrollable factors.
2. Accuracy is not subject to adjustment of meter or recorder by operators or other persons.
3. Accuracy is not affected by reasonable overloads.
4. Accuracy is permanent because measuring chambers are surrounded by precision-machined, cast iron surfaces.

Compactness of R-C Meters permits installation in cramped spaces. Sizes from 4,000 cfh to 1,000,000 cfh provide range for all sewage treatment applications. Indicating and recording devices are available. Ask for details in Bulletin 40-B-14 or write us about your needs.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Mount Avenue, Connersville, Indiana

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1900

ONE OF THE DRESSER INDUSTRIES

Cincinnati to determine if unsuspected public health hazards exist as a result of trace constituents from industrial wastes that find their way into streams. What will they say about cobalt?

Sludge digestion tanks have been insulated by earth embankment, wood covering, hollow tile, dead-air space, cork, concrete, brick, and asbestos.

The only real wealth of an individual is his health and this is not generally appreciated until it is lost.

Florida has 108 waste disposal projects that have been approved by the state health agency in the past three years.

Safe handling of radioactive wastes in the atomic energy program is discussed in a 30-page brochure, issued by the Atomic Energy Commission.

The milky appearance of water drawn from faucets is caused by the escape of a multitude of small gas bubbles that separate from the water when the pressure of the water is released.

Virginia Bill Proposed to Authorize Fluoridation

A somewhat unusual approach to the adoption of water fluoridation appears in a bill recently proposed by State Sen. Charles R. Fenwick in the Virginia General Assembly. The bill would authorize cities and towns to use fluorides in municipally owned water systems. Regulation of the treatment would be vested in the State Board of Health.

Senator Fenwick said the recommendation has the indorsement of the State Dental Society and the Virginia Council on Health and Medical Care, of which he is legislative committee chairman.

Water Rates in the "Good Old Days"

In Lyons, Neb., when the Village Board of Trustees adopted an ordinance increasing water rates, Supt. E. D. Bonine prepared an article for the local newspaper explaining the necessity for the increase. He copied from the Lyons Ordinance Book charges for the year 1907:

	Per Year
Banks, including one basin	$ 4.00
Bakery	5.00
Barber shops, first chair	5.00
each additional chair	2.00
Bath Rooms, public, first tub	5.00
each additional tub	2.50
Brick Yard	Meter Rate
Churches	4.00
Eating Salons & Restaurants	10.00
Hotels	10.00
Livery Stables, including washing carriages, for each stall	.75
Stores, including right to sprinkle street to center and washing windows	5.00

1925 Ordinance:

	Per Month
First National Bank	$ 5.00
Restaurants, Drug Stores, Butcher Shops	1.90
Filling Stations	1.30
Modern Homes	1.30
Business Places, with toilet	1.00
without toilet	.60

The present rate which is 20,000 gallons at 25c per thousand minimum charge of $3.00 per quarter, all over 20,000 gallons 15c per thousand gallons, went into effect in 1948.

The water softening system was put in operation the first of November and the customers are now receiving that much talked about soft water. Soft water costs considerably more whether it is softened in a central plant or the individual operates his own softener. For example let's compare the minimum user. The present minimum water bill in Lyons as well as in many towns is $1.00 per month and the minimum individual softener charge is $2.00 per month, making a total of $3.00 per month for soft water. Under the new rate the minimum user will pay $1.25 per month for soft water.

Manufacturers & Equipment News

Chemical Weed Killer "Erases" Dense Growth

301

E. I. DuPont De Nemours & Co., Inc., has developed a new non-selective chemical weed killer which "erases" dense growths of mixed grasses and broad-leaf weeds, leaving only an expanse of bare soil.

Known as CMU, short for 3-(p-chlorophenyl)-1, 1-dimethylurea, the chemical has undergone extensive tests under a wide range of field conditions during the past year.

CMU is not flammable or corrosive. It is relatively non-volatile and has been applied as a spray, using a wettable powder dispersed in water. Laboratory tests have shown it to be extremely safe so far as toxic effects on warm-blooded animals are concerned.

De Laval Appoints Metzgar

De Laval Steam Turbine Company, Trenton, N. J., has announced the appointment of J. H. Metzgar as Sales Manager of the Standard Products Division.

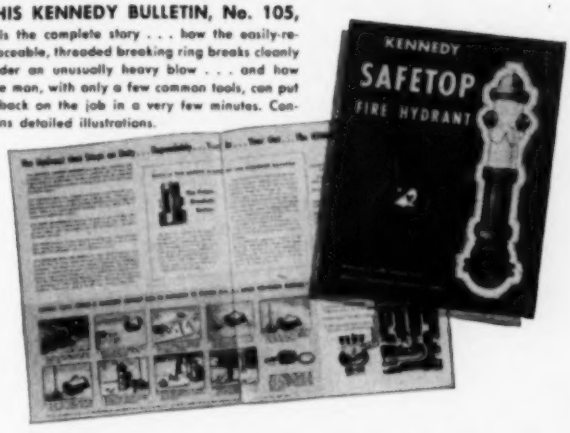
Prior to his appointment, Mr. Metzgar has been a De Laval Sales Engineer, a Commander in the U. S. Navy from 1942-45 and a Sales Engineer for Ingersoll-Rand Company. He holds a degree in mechanical engineering from Lafayette College.

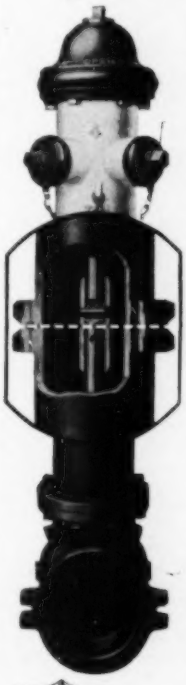
Executive Staff Promotions At Dorr Company

Dorr Company, Stamford, Conn., has announced the following promotions in the executive staff: Mr. J. Delano Hitch, formerly Vice Presi-

See how one man can repair a KENNEDY SAFETOP hydrant in only 11 minutes . . .

THIS KENNEDY BULLETIN, No. 105, tells the complete story . . . how the easily-replaceable, threaded breaking ring breaks cleanly under an unusually heavy blow . . . and how one man, with only a few common tools, can put it back on the job in a very few minutes. Contains detailed illustrations.





KENNEDY SAFETOP FIRE HYDRANTS are the toughest to knock out . . . yet, the easiest, the quickest, and the most economical to repair, even after being smashed or broken by a car or truck. This means a substantial saving for your community . . . in labor and maintenance costs. It also means better, safer fire protection. And it can make *your* job easier, too!

GET ALL THE FACTS! You'll want this informative KENNEDY hydrant booklet in your files. It gives valuable information on the design and maintenance of *modern* KENNEDY Fire Hydrants.

WRITE TODAY FOR KENNEDY SAFETOP BULLETIN 105

THE COMPLETE KENNEDY LINE includes a wide range of A.W.W.A. valves, as well as fire hydrants. Valves are made with iron 50% stronger than ordinary cast-iron . . . in a wide variety of types. Sizes from 2" to 60". For extra quality and dependability, standardize on KENNEDY.

WRITE FOR BULLETIN 106

THE **KENNEDY** VALVE MFG. CO. • ELMIRA, N.Y.

Est. 1877

VALVES • PIPE FITTINGS • FIRE HYDRANTS

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

dent in Charge of Sales has been promoted to the position of Executive Vice President; Mr. T. Bartow Ford, until recently Manager of International Sales, has succeeded Mr. Hitch as Vice President in Charge of Sales, and has been elected a director of the company. Mr. John H. E. Fedeler, an Assistant Manager of International Sales, has succeeded Mr. Ford as Manager.

Mr. Hitch, a resident of Westport, Conn., spent his early life in Denver and Colorado Springs. He came East to take his civil engineering at the Harvard Engineering School in the class of 1927, and went to work for the Dorr Company in Los Angeles and Chicago in the summer of that year. From 1929-1937 he was the company's far eastern representative with headquarters in Tokyo. He returned to New York in 1937 as Export Sales Manager. In 1945 he went to China for the last six months of the war as Technical Adviser to the Office of Strategic Services. In 1946 he was elected a director of the company and Vice President in Charge of Sales.

Mr. Ford, also a resident of Westport, Conn., has received his degree in chemical engineering from the Georgia School of Technology in 1926 and began his work then with the Dorr Company in its Atlanta office, first as a junior engineer, and later as manager of that office. In 1936 he was assigned to Tokyo, succeeding Mr. Hitch in 1937, as administrative head of the company's activities in Japan and the territories of Manchuria, Korea and Formosa. In 1941 he returned to the United States, becoming Assistant Manager of the company's Industrial Division, with headquarters in Chicago, and in 1946, Manager of International Sales with headquarters in New York, later Stamford.

Mr. Fedeler, who succeeds Mr. Ford as Manager of International Sales, is a mechanical engineering graduate of Stevens Institute of Technology, 1932, who had ten years of filtration experience before joining the Dorr Company in International Sales.

Close-up view of pulling a pipe from centrifugal casting machine.

General view showing three centrifugal machines in operation.

2 PIPE PER MINUTE

Pipe making "ain't what she used to be." It is vastly improved. More than 2 Cast Iron Pipe per minute are turned out by McWane-Pacific DeLavaud Centrifugal Pipe Foundries. At these pipe shops you see modern automatic machinery at its highest development in the pipe industry. A great centrifugal machine acts almost human. Each second trip the machine makes across its bed, a complete cast iron pipe rolls out. The machine pours its own iron and casts a pipe automatically—18' long, a true circle in diameter and absolutely even in wall section throughout. The process is a fascinating operation. Come and see it sometime.

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

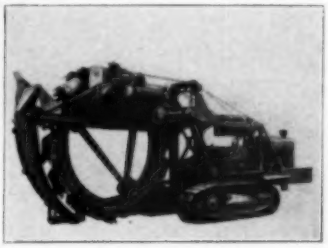
Sales Offices

Birmingham 2, Ala.	P. O. Box 2601
Chicago 1, Ill.	333 North Michigan Ave.
New York 4, N. Y.	80 Broad Street
Kansas City 6, Mo.	1006 Grand Avenue
Dallas 7, Texas	1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

Provo, Utah	P. O. Box 18
Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't Co.



Wheel-Type Trenchliners

302

Parsons Company, Newton, Iowa, has started full scale production on two new models of Trenchliners. Both are full crawler-mounted, wheel-type machines. Model 202 (here pictured) is designed primarily for drainage and utility trenching, and Model 215 is a special pipeline Trenchliner.

With a choice of either 52 h.p. gasoline or 55 h.p. Diesel engine, the Model 202 is equipped to dig in 30 separate feeds from 6.2 inches to 18.5 feet per minute; and in 9 widths from 13 to 31 inches wide and up to 6 feet deep. Other features include: friction clutch control of digging wheel, easily changed bucket-fronts with cutting lips or "Tap-In" teeth, shiftable and reversible belt conveyor for discharging spoil on either side of machine.

Parsons companion Model 215 has several features designed for "mile-a-day" production on cross-country pipeline installations; 6 digging wheel speeds up to 11.2 r.p.m., standard-make tractor type crawlers with lug-type shoes, 18 inch treads, and choice of two standard-make 55 h.p. Diesel engines.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Full crawler mounted, with either 16 or 20 inch treads, the Model 202 Trenchliner has only 5 to 6 pounds per square inch ground bearing pressure. This is particularly important on drainage, irrigation, municipal and utility-type projects for which the machine is particularly designed. For laying drainage tile, a special box and chute are available as optional equipment.

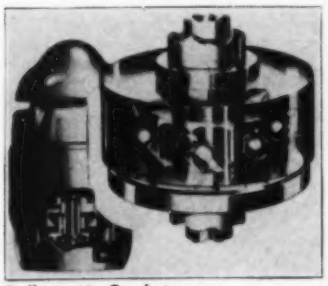
Rockwell Appoints O'Grady Sales Manager

Rockwell Manufacturing Co., Pittsburgh, Penna., has announced the appointment of Joseph F. O'Grady as Sales Manager of the Company's Water Meter Division.

Mr. O'Grady started with Rockwell in 1940 in the headquarters sales department and became supervisor of sales for the Pittsburgh district in 1947. Prior to this he had been associated with the Iroquois Gas Co. in Buffalo, New York.

In his new assignment he will be responsible for coordinating the Company's sales program by working with the regional sales managers and keeping close contact with the district offices which are maintained in all major cities of the United States.

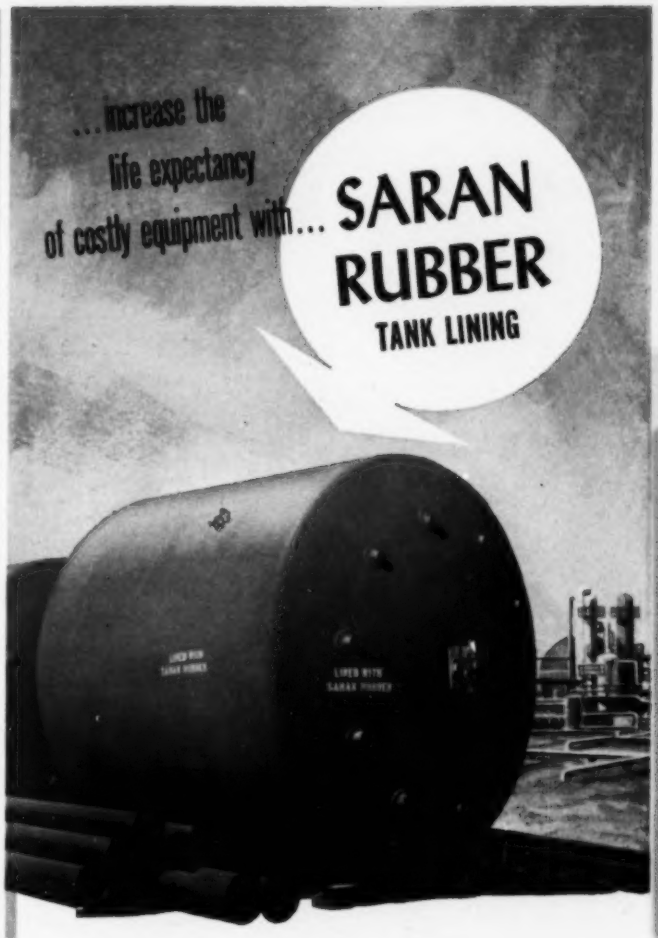
Mr. O'Grady succeeds G. H. Gleeson, who will remain wth the Company in a consulting capacity.



Ballomatic Backstop For Vertical Motors

303

U. S. Electrical Motors, Inc., Los Angeles, Calif., has developed a new method of preventing reversal of U. S. vertical hollowshaft motors, to



Saran rubber, one of Dow Chemical's superior developments in tank linings, has combined the physical properties of rubber with the chemical resistance of saran. This high degree of chemical and abrasive resistance makes saran rubber an outstanding lining where resistance to grease, many solvents, acids and other chemicals is indicated.

Saran rubber can be applied easily, effectively and economically by experienced tank lining applicators located strategically throughout the country.

Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office —and find out how you can preserve the life of costly equipment.

Write to the Distributor:

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Saran Lined Pipe Company

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Offices in: New York • Boston • Philadelphia • Pittsburgh Chicago • Tulsa • Indianapolis • Houston • San Francisco Los Angeles • Portland • Cleveland • Denver • Seattle Charleston, S.C. • Toronto

SARAN RUBBER a DOW product

prevent damage to bearings in vertical turbine water pumps when the motor current ceases.

The new method uses steel balls, the geometric form most ideally suited to provide quick engagement and maximum strength. When the motor starts, centrifugal force throws the hardened steel balls out of engagement with the stationary member. When the motor stops, gravity pulls the balls down and one of them engages between the rotating member and the stationary ratchet, thus preventing reversal.

The backstop, U. S. Ballomatic, is designed with a different number of balls and ratchet flutes which multiplies the possible number of locking positions in one rotation, thereby reducing impact and resultant wear to the minimum.

De Laval Appoints Cromwell

De Laval Steam Turbine Company, Trenton, N. J., has announced the appointment of C. E. Cromwell as Sales Manager of the Commercial Division.

From 1939 to 1949, Mr. Cromwell was a De Laval Sales Engineer and District Manager of the Detroit office from 1949-51. He served as a Major in the U. S. Army, Engineer Corps, from 1942-46. He is a graduate of the Rose Polytechnic Institute with a degree in mechanical engineering.

LOW ON MAINTENANCE
LONG ON SERVICE

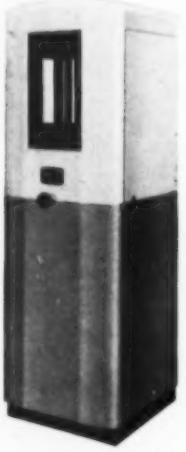
BUILDERS Visible Flow CHLORINIZERS are low on maintenance and long on service. They require less *costly* maintenance and less *frequent* maintenance than any chlorinating equipment on the market.

FEATURES CONTRIBUTING TO LOW MAINTENANCE . . .

Builders Chlorinizers are simple in design — they have only one vital control part, the tantalum diaphragm control valve. The chlorine flow system is extremely short — totally free from stuffing boxes and other mechanisms requiring frequent attention.

Builders Chlorinizers meter and control chlorine gas in the same dry non-corrosive state as it comes from the steel cylinder. Even if moist conditions are encountered, low maintenance is assured by the materials used in the control valve: tantalum diaphragm, porcelain lining, silver, Hastelloy "C".

Builders Chlorinizers are of unitized construction — they're built of standardized assemblies, easy to repair, easy to replace.



Chlorinizers are available in three volumetric models — for any chlorination service:

Up to 400 pounds per day, Model DVSX, Bulletin 840-F2A
Up to 2000 pounds per day, Model CVS, Bulletin 840-F1
Up to 6000 pounds per day, Model HCVS, Bulletin 840-G27

For Bulletins, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 360 Harris Ave., Providence 1, Rhode Island.

BIF INDUSTRIES

BUILDERS PROVIDENCE *Instruments*

BUILDERS

New Portable pH Electrometer

304

Coleman Instruments, Inc., Maywood, Ill., has announced the development of the new Model 20 "Compax" pH Electrometer.

The Model 20 "Compax" is a self-contained, portable pH Electrometer combining the precision of the linear potentiometer with the simplicity of single dial operation. New features include a unique "Fashing Signal" which eliminates meters, pointers, and "reset" knobs and establishes the reading point with pin point precision; batteries with a useful life of more than 1,200 operating hours; complete protection against measurement errors due to depleted batteries, amplifier drift, or accidental misadjustment of controls; an electrode system which is automatically brought to operating position when the instrument cover is opened, and returned to storage within the case when the cover is closed. All operations of standardization and measurement are accomplished with a single calibrated dial. There are no other knobs or controls required.

The entire instrument is enclosed in a stain-proof plastic case, and weighs 5½ lbs.

Pipe Linings, Inc. Acquires Centriline Process Territory

Pipe Linings, Inc., Los Angeles, Calif., a subsidiary of American Pipe and Construction Co., is now in a position to handle the relining of cast iron and steel pipe lines in the western states and British Columbia, using the Centriline process for pipe lines 16 to 144 inches in diameter. Pipe Linings, Inc. will continue to offer their own Tate process for re-

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

lining pipe lines 4 to 16 inches in diameter.

In obtaining this territory for the Centriline process, Pipe Linings takes over all of the equipment and machinery of the Centriline Division, American Pipe and Construction Co., former licensee.

As a result of the new arrangement, Pipe Linings, Inc., now offers complete facilities for relining water, oil, and gas cast iron or steel pipe lines from 4 to 144 inches in diameter.

New Four-Wheel "Payloader"

305

Frank G. Hough Co., Libertyville, Ill., has made available another four-wheel drive "Payloader" tractor-shovel.

The new "Payloader" has a one-cubic-yard bucket with 60 h.p. Diesel or 54 h.p. gasoline power optional. The use of large pneumatic tires, same size all around, and drive on all four wheels gives this new "Payloader" tremendous traction and flotation to work effectively in sand, mud and snow and travel on pavements without injuring the surface.

Rear wheel steer with power booster plus short wheel base makes it easy to operate and highly maneuverable. Four speeds in both directions insure fast travel speeds for transport and fast operating speeds on shuttle loading or similar operations. Fingertip-controlled hydraulic power raises-and-lowers and dumps-and-closes the bucket.

New Cathodic Protection Firm Formed

The Stuart Steel Protection Corporation (STEPCO) has recently

High Service Pump Room, Evanston, Illinois Water Works

climax BLUE STREAK ENGINES

Staying Power FOR STANDBY SERVICE

Climax Blue Streak Engines drive generators and pumps in standby service, or furnish continuous power where natural or by-product gas is available in municipal water works plants.

For water works service Climax Blue Streak Engines are the choice because of their low upkeep expense, extra quick starting and sufficient surplus capacity to supply power for an indefinite period of time.

Two Climax 12 cylinder, 6½ x 7, 425 H.P. Gasoline Engines Direct Connected to 10 MGD Pumps for Standby Service in Evanston Water Works.

Write for complete information and specifications on these dependable power plants. There are 4, 6, 8 and 12 cylinder engines, rated from 40 to 600 H.P., operating on natural gas, Butane or gasoline. Sewage gas engines are available in sizes 50 to 250 H.P.

climax ENGINE AND PUMP MFG. CO.

Factory and General Office Clinton, Iowa

Regional Offices Chicago - Dallas

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

been formed by Linden Stuart as Chairman of the Board and Linden Stuart, Jr. as President. The offices and warehouse of the Corporation are located at 2 Mark Road, Kenilworth, N.J.

STEPCO is Eastern Distributor of Dowell Magnesium Anodes and can assure prompt delivery from the large stock in its New Jersey warehouse. A complete line of Cathodic Protection supplies and equipment is carried locally such as Cadwell welding kits, Good-All Rectifiers, National Ground Anodes, Pipe Locators, Instruments and Insulating Materials; plus T. D. Williamsons' WmSeal Casing Bushings and "Concentric Support" Casing Insulators for pipeline road crossings. The new company is also a distributor of cold applied Bitumastic Industrial Coatings and other specialty coatings for severe corrosive conditions.

Byron Jackson to Acquire A. D. Cook Pump Co.

Byron Jackson Co., Los Angeles, Calif., has entered into an escrow agreement with Oliver L. Bardes of Cincinnati, owner of the A. D. Cook Pump Company, to purchase the assets of his organization located at Lawrenceburg, Indiana, according to an announcement by E. S. Dulin, President, Byron Jackson Co.

These assets will provide Byron Jackson Co. with 150,000 additional square feet of manufacturing space and modern facilities which can be used for the production of Byron Jackson Centrifugal pumps and Cook vertical turbine pumps.

LEOPOLD
Glazed Fire Clay
TILE FILTER BOTTOMS

Successfully serving over 200 PLANTS with a daily capacity of over THREE-QUARTER BILLION GALLONS

Check THESE LEOPOLD FEATURES:

Permanent · No corrosion or tuberculation · Economical · Equal distribution · Uniform filtration · Low loss of head · No large size gravel required · Proved superiority · No metal in contact with water!

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Columbia, Mississippi
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Billings, Montana
Lincoln, Neb.
Lima, Ohio
Bartlesville, Okla.
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Allentown, Pa.
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Norfolk, Va.
Wheeling, W. Va.
Menasha, Wis.
Worland, Wyo.
Passaic Valley Water Commission, Little Falls, N.J.

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2413 W. CARSON ST., PITTSBURGH 4, PA.
COMPLETE WATER PURIFICATION and SEWAGE PLANT EQUIPMENT
DRY CHEMICAL FEEDERS · FILTER OPERATING TABLES · MIXING EQUIPMENT

New Type Metal Detecting Unit

306

Fisher Research Laboratory, Inc., Palo Alto, Calif., has available a new type metal detecting unit.

The new unit is specially designed for detecting small near-surface metal objects such as lost weapons, tools, pavement covered manhole covers, valve boxes, keys, etc. The unit can be used for locating metal objects beneath soil, rock, cement, asphalt, wood, snow, ice, brick, and fresh or salt water. In addition the equipment can be used for locating metal objects, cables, pipe, etc., behind brick, plaster or adobe walls. Metal objects are easily identified by a distinctive earphone tone as well as a visual meter indication.

The unit is a single loop detector somewhat similar in principle to an Army Mine Detector. Simplicity in operation and durability under extended usage have been stressed in the design and construction of this equipment. The power supply is provided by a low cost dry cell battery complement. Easy portability is assured through the instrument's light weight, approximately seven pounds.

Silicone Base Masonry Water Repellent

307

Ranetite Manufacturing Company, Inc., St. Louis, Missouri, has developed a new formula with a silicone base for making masonry water repellent.

(Continued on page 99A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

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WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

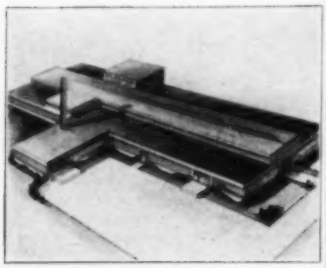
These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(Continued from page 98A)

The new silicone base water repellent is for surface application to exterior, above grade masonry and, according to the company, offers the following advantages: Quick to develop repellency after application; Versatile—performs well on most types of masonry; Easy to apply either by spraying or brushing; Readily applied at temperatures as low as freezing; Highly effective against efflorescence; Clear and invisible, causes no change in masonry appearance; Penetrates deeply to insure durability; Non-sealing of masonry pores, allowing the masonry to "breathe"; Paintable, oil base paints adhere and do not impair the water repellency of the underlaying mortar.



Glauber Building New Plant in Texas

Glauber Brass Inc., Kinsman, Ohio, has announced the construction of a new modern $440,000 plant at Tyler, Texas.

This new operation is incorporated as Glauber of Texas, and according to information from Sylvan Grotte, Vice-President and General Sales Manager, this new plant will enable Glauber to better serve their many customers in all plumbing markets.

Contracts have already been awarded for the first building having 37,600 square feet of floor space on a site of 5.2 acres. The building will be monitor type construction and will cost $190,000. It will be equipped with the latest type of foundry facilities and modern precision machine tools for the production of a complete line of valves and plumbing brass fixtures.

Pittsburgh-Des Moines Opens Los Angeles Office

Pittsburgh-Des Moines Steel Company, Pittsburgh, Penna., has announced the opening of a new Los Angeles sales office.

The new office is located at 6399 Wilshire Boulevard and will be under

SMITH BLAIR INC.

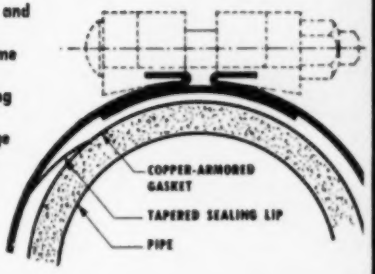
Full Circle CLAMP COUPLINGS

Widths. 5" to 30"
Sizes: 2" to 12"

★ For PERMANENTLY repairing broken or cracked pipe

By utilizing the flexibility, durability and strength of copper or stainless steel, the Smith-Blair Full Circle Clamp Coupling has proved itself to be a revolutionary repair unit. It is fast becoming the standard method of repair for the water works throughout the United States and Canada. It is a permanent repair unit for any type of pipe.

- Lowers Initial Cost
- Minimizes shut downs and shut down time
- Reduces installation time required
- Requires less excavating for installation
- Gives higher percentage of complete shut-offs on the first try — under pressure.



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South San Francisco, California
BRANCH:
8241 Phlox St., Downey, Calif.
DISTRIBUTORS IN PRINCIPAL CITIES

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P.O. Box 666
NAME:
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EXPANDING ROOT CUTTER & SEWER CLEANER

Open and in action removing roots and caked sediment like this.

It Fits in on Every Sewer Cleaning Job
Adjusted in 30 seconds to fit any sewer from 8 to 30 inches.

Will clean the entire sewer wall, top, and sides as well as the bottom, cutting and removing the roots and caked sediment, putting the sewer system in almost 100% clean condition.

Write for our new catalog on complete sewer cleaning equipment.

EXPANDING SEWER MACHINE CO.
108 East Walnut St.
Nappanee, Ind.

Save man hours

with the **EDDY**
Mechanical Joint
VALVE

After excavation, two unskilled workmen with a ratchet wrench can install these valves in a jiffy . . . and every joint will be *bottle-tight* under pressure. What's more, they can do the work in a flooded trench, or in any kind of weather, for no caulking, no lead-melting is needed. Eddy Mechanical Joint Valves meet AWWA specifications, and are available in sizes 3" to 12" for use on both centrifugally-cast and sand-cast iron water pipes.

EDDY
VALVE COMPANY
WATERFORD NEW YORK
A subsidiary of James B. Clow & Sons

the direction of R. C. Boss, who has been transferred from the company's Santa Clara plant offices.

Trench Digger Mounted on Tractor

308

Badger Machine Company, Winona, Minn., has developed a new modification of the Hopto Digger that can be mounted on a tractor.

The unit is completely hydraulic, and is operated from a power take-off. Having a swing of 180°, a reach of 16 feet, the unit will dig to a depth of 9 feet. The lifting capacity is 2,000 pounds but larger capacities are possible with the use of stabilizers.

Dearborn Chemical Adds Tinsler

Dearborn Chemical Company, Chicago, Ill., has announced the addition of William A. Tinsler, Jr., to the company's sales staff. Tinsler is a Purdue University graduate in chemical engineering, and served as an ordnance specialist in the Navy during World War II.

Prior to his addition to the Dearborn sales staff, he was engaged in research development and in corrosion engineering.

Badley Joins Neptune

Neptune Meter Co., New York, N.Y., has announced that Mr. Willis Harry Badley has joined the sales force and will assist Mr. A. D. Mars, Jr., in representing the company in the States of Montana, Colorado,

SINCE 1885

GRUENDLER

the choice again in

1951

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SEWAGE—GARBAGE SHREDDERS

Disintegrate the waste for continuous flow!

Bulletin S. G. 10 mailed on request

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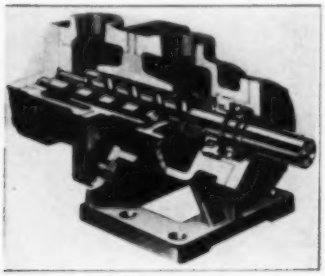
2918 North Market
St. Louis 6, Mo.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Wyoming, Idaho and Utah, in the sale of Trident Water Meters.

Mr. Badley attended Kansas State College at Manhattan and majored in Chemical Engineering. Prior to coming with Neptune, he served four years in the U. S. Air Force. He is the son of Harry W. Badley who has for many years represented the Neptune Meter Company in the State of Kansas.



Low-Cost IMO Pump for Higher Pressures

309

De Laval Steam Turbine Company, Trenton, N. J., has announced a new De Laval-IMO pump, which saves up to 40 per cent in initial cost over other IMO models for similar pressures.

This new rotary positive displacement pump offers all the advantages of the IMO spiral displacement design. It has only three moving parts. It is reliable, quiet, pulsation-free, compact, excellent for high-speed operation. The pump can be used for capacities to 80 gpm, pressures to 275 psi and intermittent pressures up to 325 psi.

Koppers Builds New Research Center

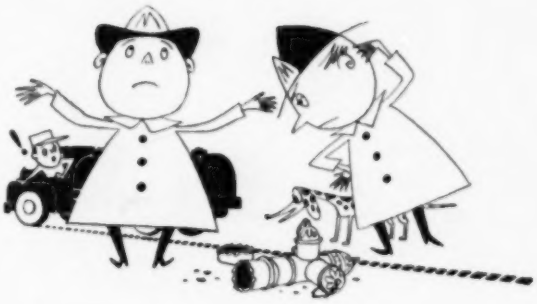
Koppers Company, Inc., Pittsburgh, Pa., has announced that the Company will embark on an enlarged and more unified program of research, with a major portion of such work centered at Verona, Pa., where new laboratories are now nearing completion.

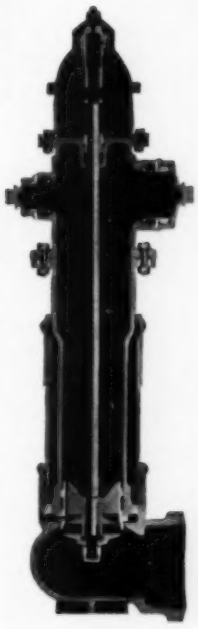
General Somervell, President, stated that the Company has purchased a plant site it formerly leased at Verona, re-arranged its buildings and added a new building, which will contain administrative offices, the Company's Research library and conference rooms.

Dr. G. F. D'Alelio, Vice President and Manager of Koppers Research Department, revealed some of the plans for the new center.

"Within a few months, a major portion of our research will be cen-

Broken hydrant cannot leak!





The main valve opens against water pressure and closes with it. This is foolproof protection against flooding when hydrants are broken in traffic accidents.

MATHEWS
HYDRANTS

Made by R. D. Wood Company Public Ledger Building, Independence Square, Philadelphia 5, Pa. Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves.

Mathews Modernized Hydrants . . . Tops in Convenience and Dependability Compression-type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in barrel • A modern barrel makes an old Mathews good as new • Available with mechanical joint pipe connections

TG
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SODIUM FLUOSILICATE
(Silico Fluoride)

Inquiries Invited

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SERVICING
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INDUSTRIAL WATER TOWERS

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COMPLETE PAINTING AND REPAIR SERVICE
822 N. Court St. Rockford, Ill.

CEMENT GUN COMPANY RELINES SETTLING BASINS WITH GUNITE

Photograph above shows three of four Settling Basins at a Virginia City's Municipal Water Works during the course of being relined with "Gunite." The concrete in this structure had disintegrated considerably, due to chemical and frost action.

Cement Gun Company crews replaced a "Gunite" lining on the floor and on the exterior walls of the basins and, in addition, grouted under the floor of all four basins to solidify the structure.

Additional reinforcing of steel mesh and "Gunite" was added at all corners where failure was indicated by leakage and the presence of large cracks.

This is just one of many typical "Gunite" repair jobs which have been done. For information on "your job" and description of many other "Gunite" jobs, performed by us, send details and request catalog (C) 2400—on your letterhead, please.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

LATEST EDITION
CATALOG No. 600-10
MANY NEW TESTS
FOR ANALYSIS OF WATER, SEWAGE AND INDUSTRIAL WASTES

SEND FOR YOUR FREE COPY TODAY!

hellige Inc.
3718 NORTHERN BLVD., LONG ISLAND CITY 1, N.Y.

tered at Verona," he said, "and by 1953 we may have nearly 200 chemists, physicists, engineers and technicians working there. Considerable new equipment is being installed in the laboratories and they will be modern in every way."

Barco Rammer Solves Soil Compaction Problems

310

Barco Manufacturing Company, Chicago, Ill., has developed the Barco Rammer for soil compaction close to walls, culverts, in trenches, ditches and abutments.

According to the company, the Barco Rammer is the product of more than ten years of research and development and works on a completely new scientifically proved principle of heavy, thrusting impact to produce deep, penetrating compaction. The Rammer is completely self-contained and portable and can produce specified compaction (97%) with lifts (layers of earth fill) of 12 to 20 inches when ordinary tampers are limited to 4 inches or less.

Records for one typical job show the Rammer averaging 6.7 feet of trench per minute with 20 to 24 inch lifts. This was at the rate of 402 feet of 18 inch trench per hour.

Omega President Moves to Providence

Omega Machine Co., Providence, R. I., has announced that L. E. Harper, President, has moved from the

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Wilmette, Ill. office to Providence, R. I.

When Builders Iron Foundry purchased the Omega Machine Co. in 1944, Mr. Harper moved from Kansas City to Chicago to establish a Chicago-Midwest District office for the parent company and Omega Machine Co. For the past several years this district office has been located in Wilmette, Ill., where Mr. Harper has been stationed. During his stay in the midwest area Mr. Harper was active in the affairs of the Ill. Section of AWWA. Hereafter, he will direct the affairs of Omega Machine Co. from the main office of the company in Providence.

"Convertible" Masonry Saw
311

Clipper Manufacturing Company, Kansas City, Missouri, has developed a "Convertible" saw that makes possible the conversion of the standard Model HD Clipper Masonry Saw to a Concrete Saw and a Track Saw.

The new saw, which is actually both a wet (Dustless) and dry saw, can be converted at any time, simply by placing the cutting head of the standard masonry saw on the "Convertible" (4 wheeled) cart. The equipment is then ready for sawing concrete or asphalt patches or trenches in building floors, drives and walks.

Through such a conversion it is possible to switch from sawing glazed tile, concrete block, and fire brick to sewer, water or gas lines and floor patches in a matter of minutes.

By placing this "Convertible" Cart on Tracks, a fourth use is accomplished. Stone slabs, Transite sheets,

SEWAGE SLUDGE CAN EARN A PROFIT

The City of Roseburg, Oregon, processes its sewage sludge with a Royer Model S-Jr.

Using a Royer Sludge Disintegrator, sludge cake direct from the drying beds can be converted into an excellent source of revenue. Just shovel it into the low hopper and the Royer does the work . . . the sludge is completely shredded, pulverized and aerated with all sticks, stones and trash removed. Additional fertilizing ingredients may be added if desired and the finished product is discharged to bag, truck or pile.

There is no sales problem involved as florists and nurserymen, gardeners, mushroom growers, parks and golf courses all are ready customers for this valuable, nitrogen-rich fertilizer.

In addition to the income from your sales you will show a definite saving by eliminating the need for sludge disposal . . . by burning, burying or trucking away. Dispose of your sludge the modern way . . . the profitable way . . . with a Royer Sludge Disintegrator.

Write for a copy of the "Sewage Sludge Datalog" containing information on the many sizes and models available.

ROYER

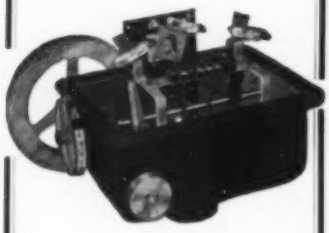
PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.

ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All Purposes
ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.
All correspondence regarding sales and engineering should be addressed to:
PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

STOP JOINT LEAKAGE USE
CARSON CLAMPS
With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.
Write for Prices.
H. Y. CARSON
1231 PINSON ST. BIRMINGHAM, ALA.

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

783 HAMPDEN AVE., ST. PAUL 4, MINN.

PLANNED FOR YOUR PROTECTION

CONTINENTAL Chain Link Fence provides better protection features—more value for your fence dollar. You get engineered erection; 12 fence styles; rigid framework secured by tough rods and wire; galvanized fabric, and welded gates. Get these plus features in Continental's "Planned-for-Protection" fence.

*Trade Marks Reg. U.S. Pat. Off.

CONTINENTAL STEEL CORPORATION
Kokomo, Indiana

Please send FREE copy of "Planned Protection"—complete manual on property protection.

Name

Address

City State

CONTINENTAL STEEL CORPORATION

pre-cast stone, large refractories, plywood and masonite can be placed under the elevated tracks and sawed with this "Convertible" Track Saw.

Ford Elected Chairman Of Central Foundry Co.

Central Foundry Company, Newark, N. J., has announced the election of David Ford as Chairman of the Board. Mr. Ford has been president and a director since 1936.

It was also announced that J. J. Nolan succeeds Mr. Ford as president. Mr. Nolan was appointed vice president in 1942. He became executive vice president and a director in 1944.

Grease Trap and Drain Cleaner

312

Chemical Research Products, Seattle, Wash., has announced a new biochemical product which eliminates cleaning of grease traps by hand.

The new product, called SEA-CHEM, contains no harsh caustics, acids or corrosive ingredients. It works by digestive enzyme action which quickly breaks down and liquidizes the grease, caked fats and starchy solids normally accumulating in grease traps and sink drains.

Non-poisonous and guaranteed harmless to plumbing or septic tanks, SEA-CHEM generates no heat or dangerous fumes when used, cannot burn the skin, and is completely safe for the user even when an excess quantity is used, it is reported.

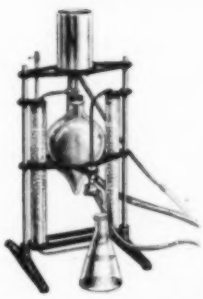
De Laval Forms Subsidiary Corporation

De Laval Steam Turbine Company, Trenton, N. J., has announced the formation of a subsidiary corporation, the De Laval Turbine Pa-

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.
607 Columbia Ave.
Darby, Pa.

ENSLOW
Stability Indicator



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

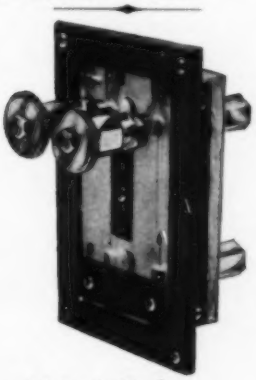
cific Company. Headquarters for the Company will be in the new building at Main and Folsom Streets, San Francisco, Calif., which was erected by De Laval in 1951.

The officers of the new Company are: Mr. G. W. Smith, Jr., Chairman; Mr. J. P. Stewart, President; and Mr. C. F. Reeves, Vice-President and General Manager.

Mr. Reeves will be in direct charge of operations of the company, continuing the duties he has held for many years as West Coast Manager for De Laval.

Branch Sales Offices are located in: Los Angeles, Calif., under H. H. Reynolds, District Manager and Seattle, Wash., under J. A. Greenland, District Manager.

The San Francisco headquarters building includes warehouse facilities for standardized De Laval products, including centrifugal and IMO Rotary pumps, speed reducers; couplings and spare parts, together with shop facilities for local handling of repair and service orders.



Purge Meter in Single or Multi-Tube Models

313

Brooks Rotameter Company, Lansdale, Pa., has developed a Mite Purge Meter, that when coupled with a "Conoflow" H-11 constant differential relay, makes liquid or gas flows easy to control. The meter is an inexpensive assembly and designed to maintain a constant predetermined flow rate regardless of variations in either the upstream or downstream pressure.

Feature of this assembly is the Brooks Mite Purge Meter which is bored from a block of acrylic plastic, eliminating troublesome packings and glass parts. Available in four tube sizes this Brooks Mite assembly has a range of 0.01 to 54 gallons per hour of water and 0.2 to 216 cubic feet per hour of air. The rate of flow is vis-

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The great volume of sewage and water plant equipment furnished and installed by Municipal Service Company is your assurance of greater savings... and more efficient production. Mechanical equipment installed has proved dependability for trouble-free, long life operation!

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ually indicated by the position of a spherical float in the metering tube. Flow adjustment is made with a Flo-Mite needle control valve.

The illustration is of one of the multi-tube models with 2 tubes. In addition 4 and 6 tube units are available.

Hough Appoints Weber

Frank G. Hough Co., Libertyville, Ill., has announced the appointment of Milton J. Weber as Vice President, Procurement.

Mr. Weber is a graduate of DePauw University, Greencastle, Indiana, and has been associated with the Sante Fe Railroad, the John Deere Distributor Organization and the J. D. Adams Co. He came to the Frank G. Hough Co. from the latter concern where he held the position of Office Manager of the St. Louis Branch. At Libertyville, he immediately took over the control of the Purchasing and Priority functions for the Hough Co. During the war he likewise assumed various Sales Department duties in the absence of the Sales Manager and supervised the Parts Department for several years.

Universal pH Meter

314

North American Philips Company, Inc., Mount Vernon, N.Y., has available a new Philips Universal pH Meter that is precision built for reliable service and for quick, accurate measurements of hydrogen-ion concentrations.

The new instrument is designed for all pH and rH work, for potentiometric titrations and for oxidation-reduction-potential investigations.

For laboratory research and industrial testing purposes it provides a measuring accuracy of 0.01 pH or 0.5 mv., a range of 0 — 14.15 pH and 0 — 1415 mv. absolutely current-less measuring with no phenomena of polarization, zero indication by cathode ray tube, can be used with glass, quinhydrone, hydrogen and platina

INSURE YOUR FILTER
AT NO COST
by using our
FILTER SAND and GRAVEL
FOR WATER AND SEWAGE PLANTS

Close attention to detail by experienced men and new modern equipment insure both the quality and prompt shipment of all orders. Our method of shipping in bulk prevents mixing of sizes in transit.

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is a bag of perfect jointing compound

BOND-O's exclusive machine blending process brings you the *one* flawless self-caulking jointing compound. The finest basic materials obtainable are so thoroughly blended by the BOND-O process—that you are assured of absolute uniformity of performance from every bag you buy.

NORTHROP & COMPANY, INC.
SPRING VALLEY NEW YORK

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

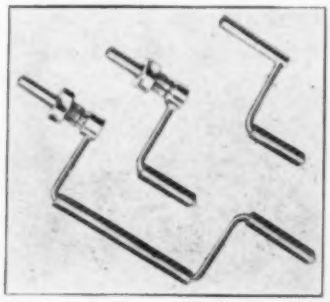
electrodes and is direct calibrated for the first three.

The meter is supplied with the new, removable Philips calomel and glass electrode and is provided with controls which correct for temperature variations and for asymmetric potentials. Unit has a built-in Philips cadmium standard cell and a flexible cable with a plug for connection to a 60 cycle a.c. power supply circuit. Transformer taps can be changed to accommodate voltages of 110, 125, 145, 200, 220, and 245.

Worthington Veteran Receives Award

Worthington Pump and Machinery Corp., Harrison, N. J., has announced that Alvin F. Welsh, veteran of 25 years of service with the company has received a sapphire-studded service pin from A. H. Borchardt, vice president in charge of the sale of Worthington pumps. The presentation was made in an informal ceremony in the reciprocating pump sales department, of which Mr. Welsh is manager.

After attending St. Mary's College, St. Mary's, Kansas, Mr. Welch started as an estimator at Worthington's Tulsa office in 1925. In 1930 he became an estimator in the Los Angeles office and in 1931 moved to the Kansas City office, becoming a sales engineer there in 1937. In 1942 he was transferred to the Reciprocating Pump Division in Harrison, N. J., of which he was made manager in 1948.



New Instrument Winder

315

J. A. Campbell Co., Long Beach, Calif., has improved on the old-fashioned key winders. The discomfort of twisting a key to wind up a clock, meter or other spring-wound control instruments is eliminated by use of a new gadget called the Campbell Winder-Upper.

The key becomes a crank. It's

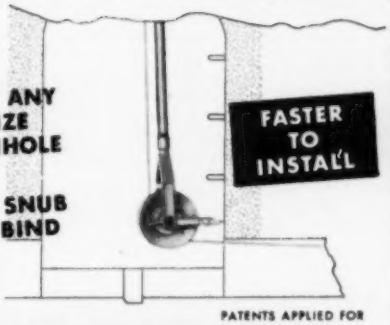
FLEXIBLE
"Surface-Hung"
MANHOLE
ROLLER

It's New!
Revolutionary!

- Operates at any angle of circle without moving machine. Adjust platform only.
- Installs in a fraction of the time of ordinary jacks. No holes to chisel in bricks.
- Hangs in manholes too narrow for present jacks.
- No rebuilding of manholes necessary. Operates in "loose brick" manholes.
- Less snub on roller eliminates cable bind. Bucket passes easier.

FITS ANY SIZE MANHOLE

LESS SNUB NO BIND



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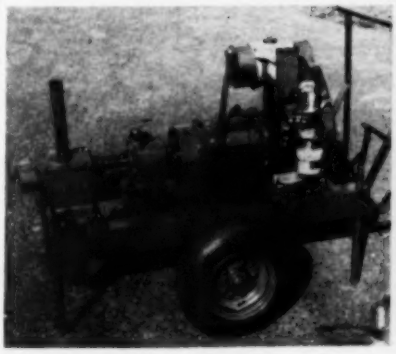

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made in three types. The simplest, Type A, consists of a key end and crank. Type B includes a torque chuck with a slip-grip arrangement which converts the crank into a combination torque wrench and crank so that the instrument cannot be over-wound. Type C is the same as Type B but is a brace design to prevent wobble. All types are triple chrome plated and have red Catalin handles.

Literature & Catalogs

Centriline Process

316

Centriline Corporation, New York, N.Y., has just published a new 2-color, 12-page bulletin on the **Centriline Process.**

The bulletin discusses the development of the Centriline Process and the advantages of applying the cement-mortar lining of pipes in place. Photographs of actual installations, showing the pipes before and after Centrilining, along with descriptive text explains how Centrilining stops leakage, permanently prevents interior corrosion and tuberculation, and permanently increases carrying capacity. Technical data specifications and an explanation of how the process works completes the bulletin.

Adjustable Port Valves

317

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Philadelphia, Pa., has just published a 12-page catalog that covers the use of Honeywell Air-O-Motor Diaphragm Operators with North American **Adjustable Port Valves.**

Complete specification data is given covering valves for gas, air, oil, steam and water regulation. Also included are mounting dimensions, material specifications, maximum pressures and step-by-step ordering information.

Complete-Line Bulletin of Hardinge Products

318

Hardinge Company, Inc., York, Pa., has just published a new 8-page bulletin, **Process Machinery,** that describes its complete line of products for this field.

It includes the following new products added to the line in recent years: oil-water separators, heavy-media separators, flocculating equipment, automatic backwash sand filters, Tricone grinding mills, lime hydrators, automatic samplers, and centrifugal clutches.

The bulletin is divided into sections by actual process operations as follows: agitating-mixing; calcining; clarifying; classifying-feeding; filtering; grinding-pulverizing; hydrating; sampling; scrubbing; thickening-concentrating-pumping; and miscellaneous.

Instruction Booklet on Centrifugal Pumps

319

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just published an instruction booklet covering the **Installation, Operation and Repair of Single-Stage, Double-Suction Centrifugal Pumps.**

The booklet recommends that a regular inspection be followed and includes a maintenance timetable which is based on continuous pump operation and which serves as a reliable pattern for all practical purposes.

RESOLUTION NO. C-2275

A RESOLUTION AUTHORIZING THE CITY PURCHASING AGENT TO ADVERTISE FOR SALE CERTAIN MUNICIPAL LIGHT PLANT EQUIPMENT NOT NEEDED FOR ANY MUNICIPAL PURPOSE.

WHEREAS, the following Municipal Light Plant equipment is not needed for any municipal purpose:

General Electric Induction Motor—vertical pump motor "Hollow Shaft Type" Model 12F340, Frame 6307, Type KF; Volts 220/440, FL Amps 110/55, 3 Ph. Cycles 60, speed full load 875, 40 H. P. Continuous 40° rise. Serial #5381366.

Crane Company 24" #793 ½ low pressure gate valve equipped with Style "P" spur geared handwheel and a 4" bolted by-pass on side of valve.

NOW, THEREFORE, BE IT RESOLVED by the Commission of the City of Piqua, Miami County, Ohio, three-fourths of all members elected or appointed thereto concurring:

SEC. 1: That the City Purchasing Agent be, and he is hereby authorized and directed to advertise for sale, according to law, the above municipal light plant equipment.

SEC. 2: That this Resolution shall take effect and be in force from and after passage.

WILBUR F. RECK, Mayor.

PASSED: November 19, 1951.

ATTEST: JOE KLASMAN, Clerk of Commission.

FOR SALE

2—Used, 20-inch vertical non-clogging centrifugal sewage pumps with cast iron enclosed impellers, designed to operate at a 25-foot head, complete with 3 phase, 60 cycle, 440 volt, 150 h.p. electric motors, and electric starting equipment. Detailed specifications will be furnished upon request.

2—Induction motors, model 62A886, type KT 926, 220 volts, 5.37 amps, 2 h.p. cent. 3 phase 1740 RPM, General Electric.

2—Direct current generators, Model 42A815, type BD 33, shunt wound, 9 amp, volts 125—1⅛ KW, 1800 RPM General Electric.

Box No. 1079, c/o Water & Sewage Works, 22 W. Maple St., Chicago 10, Illinois.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

One page of the booklet is for use as a permanent record of the operator's pump and of its performance. It is so arranged as to enable the operator of the pump to see at a glance the life of any parts replaced and any improvement due to substitute materials.

Also carried in the booklet is a quick reference guide which lists 40 possible causes of trouble in pump operation and their cures.

Fluoridizer Bulletins

320

Omega Machine Co., Providence, R.I., has just issued two four-page bulletins on Fluoridizer Dry Chemical Feeders.

Bulletin 50-H14 describes the new **Volumetric Model Fluoridizer** for feeding fluoride compounds at low rates with high accuracy. The bulletin pictures the feeder, its easy loading doors which eliminate dust, and its feeding mechanism. In addition to listing the features of the feeder, the bulletin presents ten advantages of the feeder, describes its operation and discusses feeding rates, capacities and feeding range adjustment. This bulletin also includes dimension drawings of the feeder and information on fluoride compounds.

Bulletin 30-H21 presents the **Gravimetric Fluoridizer** for the addition of fluoride compounds to water supplies with utmost dependability and extreme accuracy. Among the features listed are: high accuracy, non-flood feeding mechanism, sentinel alarm, efficient dissolver, and recorder of amount fed. Among the accessories listed as available are: chart recorder, remote rate setters, automatic proportional control, and dust collectors.

This bulletin describes the feeder and its operation, presents information on fluoride compounds and gives the principal dimensions of the feeder. Photographs show typical installations, and filling operations.

Flow Meters

321

Bristol Company, Waterbury, Conn., has just published a new 40-page bulletin describing the company's **"Series 500"** line of flow Meters.

The bulletin describes instruments for recording, integrating, indicating, automatic controlling, and telemetering the flow of steam, water, air, gas, oil, solutions, and other fluids. Both mechanical and electric type flow meters are described in a

JAEGER TRAVEL-AIR COMPRESSOR
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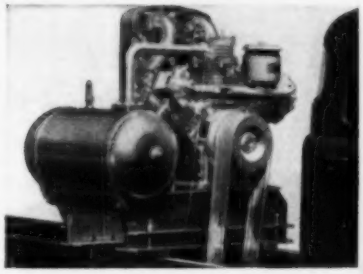
more air-125 cfm
no vibration
simple automatic engine speed control



Perfectly balanced "W" compressor, operated thru Cemco power take-off (no gears, only 4 moving parts) keeps 2 heavy breakers working at full efficiency with your truck engine running at easy 1750 rpm (24 mph speedometer). Engine speed automatically regulated to air demands by simple, positive control—no complicated linkage. Send for Catalog TC-1.

Saves $950 to $1000 first cost and 50% of maintenance compared with trailer types. Mounts on long wheelbase 1½ and 2 ton Chevrolet, Dodge, Ford, GMC, International.

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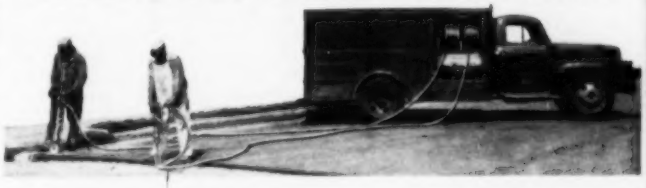

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Quotations and Bulletin 312 come at your request.

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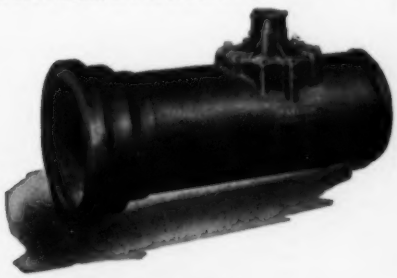
Sparling COMPOUNDS assure accurate measurement of flows ranging as wide as 1 to 125.



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If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

NOTICE OF SALE

S-142

Sealed bids will be received by the City Purchasing Officer, Room 104, City Hall, Saginaw, Michigan, until 3:00 p.m., Tuesday, April 15, 1952, and then publicly opened in the City Hall for the sale of the following:

FOR DEPARTMENT OF PUBLIC WORKS—

2—Used, 20-inch vertical non-clogging centrifugal sewage pumps with cast iron enclosed impellers, designed to operate at a 25-foot head, complete with 3 phase, 60 cycle, 440 volt, 150 h.p. electric motors, and electric starting equipment. Detailed specifications will be furnished upon request.

FOR THE FIRE DEPARTMENT—

2—Induction motors, Model 62A886, type KT 926, 220 volts, 5.37 amps, 2 h.p. cont. 3 phase 1740 RPM General Electric.

2—Direct current generators, Model 42A815, type BD 33, shunt wound, 9 amp, volts 125—1¼ KW, 1800 RPM General Electric.

Forms for making bid and conditions of sale may be obtained from the Purchasing Officer, Room 104, City Hall, Saginaw, Michigan.

The City reserves the right to accept any bid or any part thereof, or to reject any and all bids or part thereof.

R. A. BENWAY,
Purchasing Officer.

C. A. MILLER,
City Manager.

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for group of western water properties. Administrative ability important, technical background desirable. Permanent position and substantial opportunity for qualified person. Replies confidential. Box 1078, Water & Sewage Works, 155 East 44th Street, New York 17, New York.

full range of models suitable for a wide variety of uses.

Complete information is given on the various types of meter bodies, operating principles, primary devices of flow measurement, recording charts, and accessories. In addition to numerous photographs, the bulletin is liberally illustrated with reproductions of actual recording charts, and sketches of typical methods of applying the instruments.

Indicator Solutions and Reagents for pH Control and Water Analysis

322

Hellige, Inc., Long Island City, New York, has published a new attractive four-color catalog on **Indicator Solutions and Reagents for pH Control and Water Analysis.** The catalog lists 180 indicator solutions and reagents for pH measurements, water and chemical analysis with Hellige Simplex Testers, Comparators, and Aqua Testers employing non-fading glass color standards.

The catalog also states that to insure accurate results and minimize expenses, the components of less stable reagents are furnished separately so they can easily be mixed as needed.

Belt Gravimetic Feeder

323

Omega Machine Co., Providence, R.I., has issued a new bulletin on the **Belt Gravimetric Feeder.** This four-page bulletin describes the Belt Gravimetric Feeder which makes possible the continuous weighing and feeding of dry materials at capacities of from 100 to 100,000 lbs. per hr.

The bulletin lists the many features of the Feeder, describes the operation of the vibratory feeder, weighbelt, scale beam and all other pertinent parts that make up the feeder. It also shows photographs and diagrams to illustrate the mechanism.

Jet Pumps

324

Penberthy Injector Company, Detroit, Mich., has just published an attractive 20-page, two color bulletin on **Penberthy Jet Pumps.**

The bulletin explains the principle of jet pump operation and discusses steam, air, water or fluid operated jet pumps. Complete tables showing capacities of all pumps along with dimensional and pipe connection data is also shown. Photographs of the various pumps, cut-away drawings, typical arrangements and applications complete the bulletin.

Swagelok Tube Fittings

325

Crawford Fitting Company, Cleveland, Ohio, has just published a catalog on **Swagelok Tube Fittings.**

The catalog describes and illustrates the complete line of leak proof Swagelok tube fittings which are available in brass, aluminum, steel, stainless steel, and Monel. Complete dimensional information, cross section drawings, installation recommendations and assembly instructions are included.

Fluoridation Information

326

Wallace & Tiernam, Newark, New Jersey, has available a small folder titled **Fluoridation, Where?, How?, What?, Who?**

As indicated in the title, the folder discusses What fluoridation is; How many people are now served by fluoridated water supplies; How it is applied, for small, intermediate and large communities; How much it costs and Who has approved it.

Properties of Silicates and their Uses

327

Philadelphia Quartz Company, Philadelphia, Pa., has made available an illustrated 9 x 11½ inch file folder which describes briefly **Silicates of Soda,** their properties and uses as coagulating aids in raw and waste water treatment, and for corrosion control in a variety of waters.

The folder is designed to hold reprints and other literature on the subjects.

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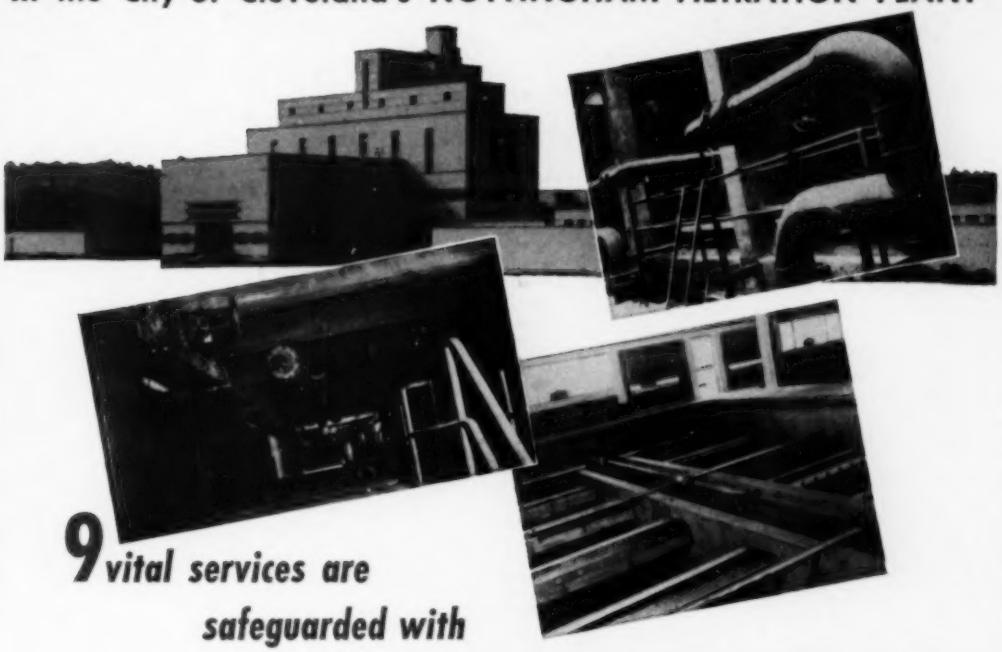

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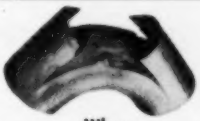

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